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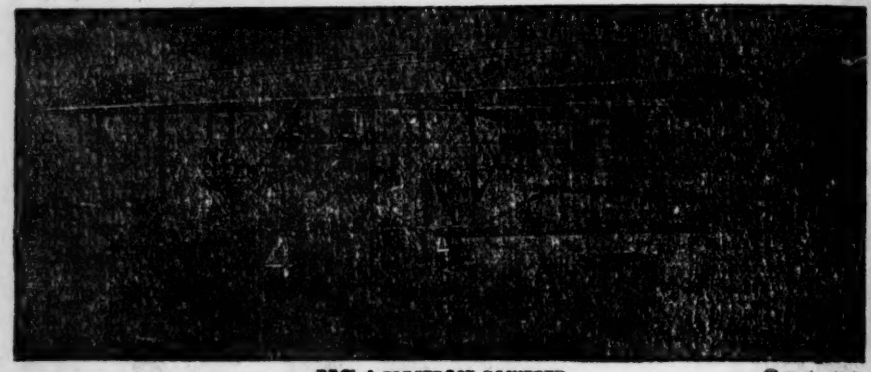

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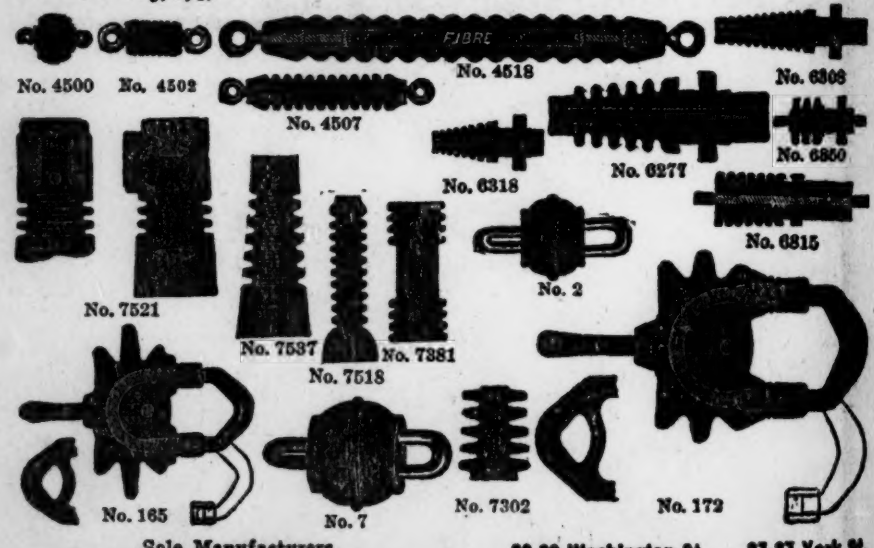

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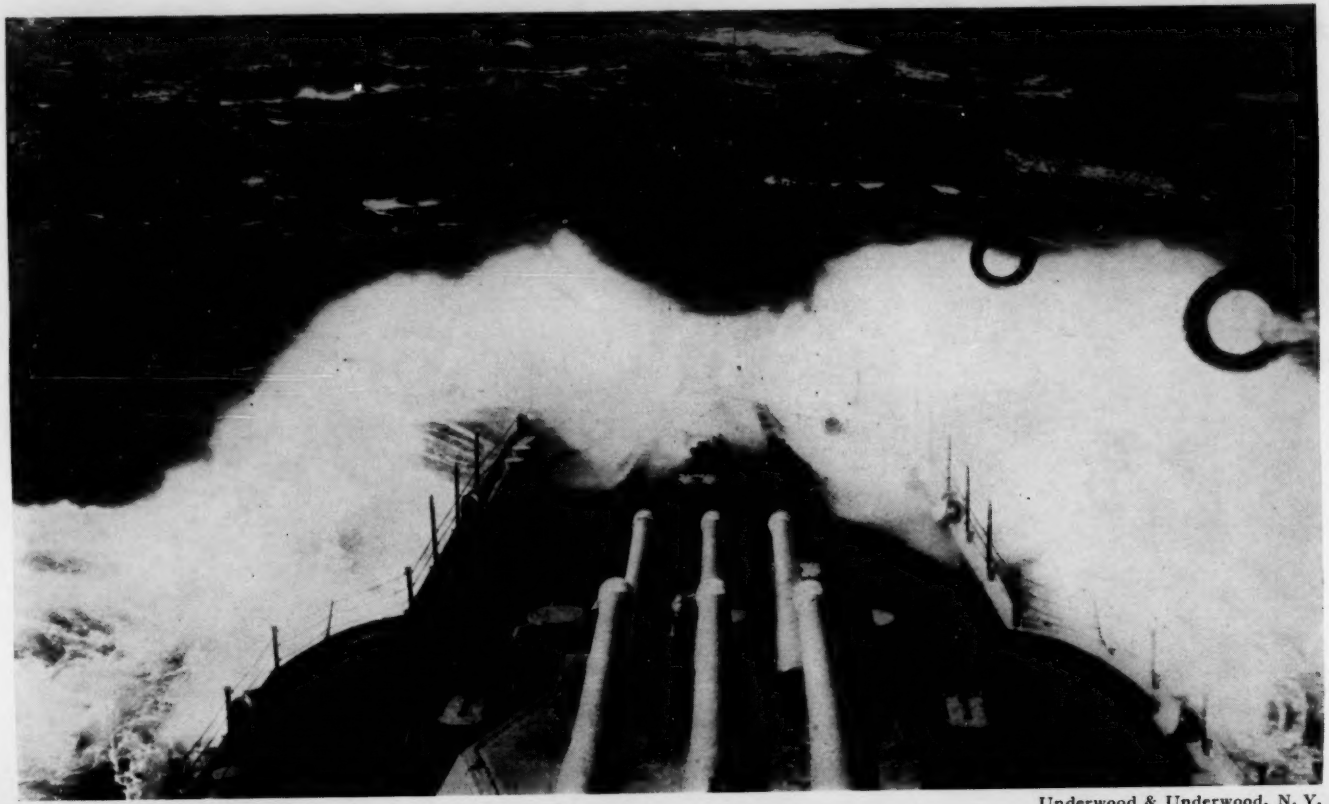

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UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. 46, No. 3 **MARCH, 1920** **Whole No. 205**

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

ON THE IMPORTANCE OF LEADERSHIP

By CAPTAIN D. W. KNOX, U. S. Navy

During the early development of the "New Navy" Admiral Mahan felt called upon to criticize line officers for being more interested in the design and construction of our ships and weapons than in methods for employing them.

That period has gone by, and the narrow outlook of which our great tutor complained has been broadened. For 20 years we have been engrossed in the important task of making our personnel expert in the use of its matériel; great attention having been given to gunnery, machinery operation, torpedo work, fleet maneuvers, radio transmission, etc. On entering the war we were highly proficient in such matters, and still retain a high degree of skill.

For some years to come, however, we are likely to continue in a state of development where skill in the handling of material will require great attention. The novel developments of the war, particularly in submarines, anti-submarine work, air craft, and mines, have broadened the requirements for skill; while the depletion of our trained personnel since the armistice, and the increase in the size of the navy, renders it more difficult to meet these requirements than under normal conditions.

Skill in the operation of ships and matériel is obviously a primary function of the personnel—skill in both the guiding hand and the directing brain. But this alone does not suffice to meet the demands of war. Probably no naval personnel ever reached

higher standards of operational skill than the Germans had acquired upon the outbreak of the Great War; certainly in the important branches of gunnery, torpedo work, engineering, and tactics, they were unexcelled. Yet no navy ever submitted to a more humiliating experience than their surrender. The collapse of morale completely nullified superlative excellence of matériel and skill in its use.

With us there has been and still is a constantly increasing recognition of the superior importance of personnel over matériel—however essential matériel may be. Perhaps we did not require the picture of the surrender of the splendid German ships to convince us of this fact. But the degree of such superiority, essential to the highest efficiency, is not believed even yet to be appreciated adequately by the service at large. It is not sufficient that the personnel be trained to the point of expertness in operating the matériel; it is necessary to go further and reach expertness in "operating" the *minds* which operate the matériel.

If men were manikins the problem of controlling and "operating" them would be relatively simple. But the human mechanism is the most complicated of all mechanisms. The manner in which it functions does not depend solely upon mechanics, but to a great extent also upon such elusive and intricate elements as instinct, emotion, ideals, beliefs, prejudices, etc. Furthermore the facility with which numbers of men may be operated collectively in large units is much less than with matériel, which is susceptible of mechanical consolidation. Hence the problem of "operating" men is much more difficult than that of operating matériel.

Broadly speaking, the officer function embraces the operation of both personnel and matériel. The leader requires knowledge of the inanimate things with which his organization must work. He should understand the principles of their construction as well as the manner of their employment. Also he should possess skill in their use—more especially their higher use—such as, in the naval profession, strategy, tactics, navigation, ship handling, gunnery, machinery operation, etc. But these requirements, excepting possibly those pertaining to the "higher command," are in reality secondary functions of officership. It is more important for an officer to understand the human mechanism than any other

mechanism; that he should know what is inside of a head or a heart better than what is inside of a torpedo or a turret; that he should be better able to get good performance out of men than out of engines. *Leadership of personnel* is his primary function. In the opinion of the writer our service is not sufficiently alive to the importance of this aspect of leadership, nor adequately acquainted with its principles—nor well enough practiced in the art. To awaken service thought on a subject, which appears to be the one remaining great branch of our profession in which we need major development, is the principal purpose of this paper.

Human experience is rich in examples of the importance of leadership as a factor in the accomplishment of any undertaking of any nature, in which the activities of numerous men are involved. The Catholic Church and the British Empire are products largely of good religious and political leadership, though of course other important factors influenced their development. The success of most of the large modern industrial companies is due principally to a high standard of leadership. From sheer necessity even the Bolsheviks were forced to accept leaders endowed with authority, notwithstanding their theoretical opposition to having a few men placed above others.

Men like Alexander, Cæsar, Hannibal, Napoleon, of course, were superlatively good leaders. The ultimate downfall of the latter was largely on account of the lack of good subordinate leaders at his command.

On the other hand, the success of Von Moltke was based upon the development of high leadership qualities among the officer body as a whole; which has been the keynote of German military and naval training ever since. To this fact principally the Germans owe their escape from annihilation at Jutland, and their uniform success on land until the last phase of the great war.

If a basic requirement of a navy is good leadership, and the highest and most important function of officers is leadership, which appear to be truisms, it follows that the education and training of officers and petty officers should be designed with that end primarily in view.

We will touch upon this aspect of the subject later. First let us formulate a conception of what the term leadership comprehends.

ELEMENTS OF LEADERSHIP

If examination be made of eminently successful organizations it will be found that their methods, with respect to personnel, are very similar fundamentally. We may take the Catholic Church, the Standard Oil Company, and the German Army of 1870 as typical examples. Some of the most important common attributes of these are:

1. Superior organization.
2. A perfected system of administration.
3. Highly developed individual and unit skill and efficiency.

The foregoing may be classified generally as *mechanical* elements and are essential to internal smoothness of operation; they are preparatory to the employment of the organization as a whole towards the accomplishment of its primary purposes.

The principal object of all these elements is to insure *co-ordination* among the several subordinate parts of the establishment. Organization and administration promote economy and timeliness; while unit skill ensures not only good unit performance, but also what is of much greater consequence—that the performance of each unit shall support the effort of all others and thus accomplish the big objects satisfactorily.

Unless the mechanical elements are developed highly they may cause such undue internal friction and wasted effort as to impair seriously the ability of the organization to succeed in its external purposes. An automobile engine whose working parts are in good adjustment and well lubricated, expends very little energy when running with the clutch thrown out, and will propel the car efficiently with the clutch engaged. But if the engine parts are in such bad condition or adjustment as to cause poor performance by one or more of them, or to prevent good coordination among the several parts, output of useful work will be limited and the car cannot be propelled efficiently, if at all. So it is with human machines.

Further examination of eminently successful organizations will disclose the existence of still other basic elements, which may be broadly classified as *psychological.* They will include:

1. High average of individual character; particularly among the leaders.
2. Proficiency of the leaders in leadership psychology.

3. Superior morale of the membership as a whole; including a general spirit of faith in and loyalty to the organization and its purposes.

The principal function of this class of basic elements is to give driving power; to invigorate the effort towards accomplishing external purposes. Without them the organization may operate internally with mechanical perfection, yet fail to produce a useful output. They are analogous to the function of the mind in relation to the body of an individual.

It would be beyond the scope of this paper to analyze the above elements fully, yet some discussion of each appears essential to the formulation of a conception of the term "leadership" in the sense in which it is believed the service should view it.

ORGANIZATION

A necessary step preliminary to engaging efficiently a number of men in any common task is organization. It is recorded in the book of Exodus that about 4000 years ago, in order to lead his tribe efficiently, Moses found it necessary to subdivide his tribe into "tens" and "hundreds" and "thousands," with subordinate leaders over each. The subordinates brought only the "hard causes" before Moses, but the small matters they "judged themselves." The fundamental difficulties of handling men collectively, and managing their affairs, will require equally of modern leaders that their first step be organization.

The basic object of organization is co-ordination; which requires unified control, or command, as a primary essential, and administration as another important essential. Any organization that we may decide upon should therefore aim first at facilitating command, and second at furthering administration. Since it is in battle that the exercise of command is of the most importance, and at the same time of the greatest difficulty, our organization should aim principally at facilitating tactical command.

An illustration of the violation of the foregoing principles is the practice on many ships of selecting from among guns' crews, men to clean the side, and the making of the administrative task of side cleaning their principal duty, under the supervision of the boatswain or other person not included in the chain of command to the battery. The old Bureau System in the Department was an

example of subordinating the requirements of command to those of administration.

There are certain well established and recognized principles of organization, some of which are cited below.

1. The channels through which the command and administration act should be as identical and permanent as practicable.

2. Every man should know exactly what he must answer for; and his authority should be coextensive with his responsibility.

3. The essence of efficient organization lies in due subdivision of labor and decentralization of responsibility among subordinates, combined with central control and coordination of subordinate parts.

4. A commander can deal directly only with a limited number of subordinates. Each of these latter directs a limited number of his own subordinates, who in turn direct others similarly. Appropriate modifications and details of the original instructions are made by each lower authority in the "chain" to suit the special circumstances of his own command. This gradually broadening system is called the "Chain of Command," and permits the original instructions to reach every individual and the effort of each individual to give the maximum support to the effort of the whole organization.

5. The number of subordinates dealt with directly by a single commander should not exceed about ten.

6. The number of steps in the "Chain of Command" should be reduced to a practical minimum.

The subject of organization is broad and doubtless has other principles, the correct application of which depends upon not only a knowledge of the principles themselves, but also of the reasons which bring them into being.

Acts of organization are necessarily of almost daily occurrence in a military service. Every activity, great or small, is organized—well or badly—and efficiency is affected correspondingly.

But the principal point to emphasize here is that to be a good leader, an officer must know the subject of organization and be a good organizer.

ADMINISTRATION

By administration is meant management, control, direction, the exercise of executive functions. It is important to differentiate

clearly between organization and administration: the first is an instrument; the second is the method of using this instrument. "The first is a form, the second is a mode of action—it is work itself."

One of the biggest lessons of the great war was that modern military operations require excellent administrative support for their success. Otherwise the necessarily complex activities cannot be performed—at least not in time, and if late they are usually of little value.

The great dependence upon administration of the multitudinous peace activities of navies is so apparent as hardly to require comment. Almost every duty, from piping sweepers to holding target practice is administrative to a large degree. The work of officers at our great shore establishments, whether navy yards, bureaus, or other stations, is probably 95 per cent administration.

We may cover up defects in organization by good administration; but no organization, however good, can avoid the penalties of bad administration. We may make laws and regulations and issue orders *ad infinitum*, but unless administration sees to their proper execution they are futile.

Administration is then one of the most important elements of leadership. No officer who fails to comprehend and apply its principles is a sufficiently capable leader, or officer.

A summary of the principles of administration as expounded by Admiral W. L. Rodgers, follows:

1. The dominating principle is—co-operation for the objective under a sole directing plan and impulse.

2. Co-ordination, the central object of administration, is obtained by

(a) Common knowledge of the objective.

(b) Common knowledge of the plan for attaining the objective, on the part of the co-ordinating parts of the organization.

(c) The maintenance of discipline.

(d) The enforcement of efficient work.

(e) A general spirit of loyalty.

Captain Bell, Medical Corps, has set down five primary principles of administration, which may be summarized as follows:

1. A single mind in control; from which emanates the plan of action and the directing authority.

2. The subdivision of delegated authority; in conformity with the branches of the organization.

3. The recognition of areas of discretion; corresponding to subdivisions of authority, but circumscribed by due loyalty to the plans.

4. The determination of the missions; and the formulation of a general plan for its attainment.

5. The exercise of a system of inspections.

The same authority has formulated eight secondary or supporting principles, of which the following is a digest:

1. *The Spirit of the Administrator.*—Successful administration depends upon certain underlying conditions which emanate from the spirit of the administrator; indicated by not only his general bearing towards subordinates and the manner of approaching the functions of discipline and inspections, but also the consistency which he observes in his personal conduct and the administrative control of others.

2. *Forms of Ceremony;* consisting not only of the conventional official "honors," but also qualities of temperament such as patience and self control, qualities of mind such as self-reliance and a sense of justice, and habits of conduct such as dignity; are valuable aids to the administrator in securing an ascendency not otherwise procurable.

3. *Discipline.*—Administration, even if purely civil, cannot succeed without discipline. It is the basis of team work, in that it makes it possible for each individual to contribute his full quota to the general objective. The restricted conception of discipline as surely requiring the sacrifice of private judgment is erroneous. In reality it is full grown will power, self control and a fitness to live and work among one's kind. An impersonal attitude of mind on the part of the administrator is essential. Justice should be tempered with reasonableness.

4. *Regulations and Rules.*—The administrator's relation to the established rules and regulations necessary in any management of affairs, exhibits the rationale of the impersonal attitude of mind. It is easier to maintain law and order where men look upon the law as a friendly guide than where they see in it only brute force.

5. *The Spirit of Inspection.*—If criticism is always adverse it creates irritation. One aim should be to give encouragement; to

foster cohesion and loyalty and thus bring about cooperation of the inspected.

6. *Consistency in Policy and Executive Acts.*—At all times everybody should know what can and cannot be done—what is expected of him and what somebody else will do—and each can then adapt himself accordingly.

7. *Esprit de Corps.*—This is engendered by two motives—the desire to perform efficient service to one's group, and the desire to receive appreciation. It must be nourished by a gratification of the underlying motives of its origin; by a human interest in the general well being of men, and by tangible benefits emanating directly from increased efficiency.

8. *Publicity.*—This helps to place the object of our loyalty in relief and gives it perspective, so that false *esprit de corps* becomes discernible and any threatened injury to the cause, in which all must share, is made clear.

The application of these and other administrative principles requires that officers be educated and trained in the administrative art. Failure to do so inevitably results in much internal friction and a lessened ability to deliver telling blows against an enemy.

INSTRUCTION AND TRAINING

The third element of leadership to be considered, "Highly developed individual and unit skill and efficiency," will complete our examination of the so-called "mechanical elements." It is obtained by means of *instruction and training* of the personnel; the necessity for which requires no argument in a navy which has had this for a hobby for generations.

It should, however, be pointed out again that skill and efficiency of individuals and units is but a preliminary object of the instruction and training; which has the higher aim of enabling units to afford each other mutual support, and thus facilitate the co-ordination and consequently the effective use of the whole force.

But whatever their objects, the work of instruction and training must be done by officers and petty officers, and will be done well or badly according to the abilities exhibited by them in this branch of leadership.

Notwithstanding the intensity with which our navy has engaged in instruction and training, to the exclusion of almost everything else for so many years, the writer is not aware that any comprehensive study of the subject has ever been made; nor that any body of principles has ever been formulated. Certainly it is a fact that very little, if any, instruction and training is given officers and petty officers in the *art* of instruction and training; even at our big training stations where such work is their primary mission.

Some pertinent principles are suggested below:

1. The development of mental capacity is of greater importance than furnishing the instructed with a store of knowledge.
2. The development of mechanical capacity is of greater importance than the development of specialized mechanical skill.
3. The development of military character is a primary object.
4. The development of quick thinking is essential.
5. Instruction, drill, and training must go hand in hand.

In this connection Balck says:

> Drill is always mechanical. Training is directed at the mentality of the man, it makes him independent and allows him to exercise initiative. . . . . Drill and training are both justified, each in its appropriate sphere; the scope of both is closely defined and neither could be dispensed with Drill assists in creating the soldier, because it develops the characteristics which must be required of a soldier; endurance in surmounting hardships and dangers, unquestioning subordination of his will to that of the leader, tenacity and trustworthiness, skill in handling his weapons. . . . . Training alone will never attain this object.

6. Clear exposition by the instructor greatly facilitates his work.
7. Instruction forced upon the mind by others is ineffectual; few have been taught to any purpose who have not been their own teachers.
8. The psychological basis of habit must be utilized.

NOTE.—In all drill and training seek to obtain the men's interest and loyalty. Otherwise a habit of insubordination is being formed automatically, which may defeat the objects of the training. Hocking says: "The insistent practice of a few unit operations until they retire into subconsciousness and become mechanical, allows the mind to be free and to think of . . . . (larger things). *Freeing the mind* is the function of all technique; no one who has to think of the individual placing of his fingers can be a pianist. It is a necessity, not a luxury, for a commanding officer to think of his command as a unit, ... Army making is a process of mental grafting; and this can only be achieved by training attention until each man's mind is rooted into the mind of his neighbor, not by his separate conscious effort, but by great subconscious blocks of habit."

To be proficient in this element of leadership, officers and petty officers must understand the relative necessity and the importance of knowledge, skill, and coordination. They must know how to get these requisites into and out of their subordinates. To be proficient leaders they must know the technique of instruction and training, as well as they do the technique of other elements.

PSYCHOLOGICAL ASPECTS OF LEADERSHIP

It has been pointed out that the psychological elements of leadership have as their principal function the giving of "driving power" to a human machine. These elements include:

(a) High average of individual military character; particularly among the leaders.
(b) Proficiency of the leaders in leadership psychology.
(c) Superior morale of the membership as a whole; including a general spirit of loyalty to and faith in the organization and its purposes.

The principal elements of character are ideals and will-power. Those who would build up character, in themselves or in others, must first fix upon the desired ideals, and then exercise or develop the will power necessary to live up to them. Since public opinion has a marked influence upon ideals, it should be utilized if it exists already, or created if it does not exist. Fundamentally, will power depends upon the power of concentration; which may be developed by exercises in concentration. The stimulation of interest facilitates such exercises greatly. Will power is further strengthened by habit, which is an invaluable ally of concentration for developing the will.

Military character is a compound of practically all the conventional human virtues, with special emphasis on a few of them, plus certain additional military virtues.

Courage is the traditional basic military virtue; but Hocking doubts whether it is a distinct and separate quality. He says, "Given discipline, experience, good condition, pugnacity and faith, you will not find courage lacking in any body of men"; and inclines to consider pugnacity as the most important virtue in military character. To quote him further as to the nature of pugnacity, "Pugnacity always personifies its object. . . . . Pugnacity first of all must be certain of itself, certain both of its facts

and of its cause. And, second, pugnacity always requires a moral motive, though its occasion is material."

It is not alone during war that special character of naval personnel is needed. We must not overlook the stresses of peace time, when rigid preparation must be made in spite of monotony and other peculiar obstacles. Then such attributes as lightheartedness, humor, unselfishness, cordiality, sociability, and many others are of great utility.

Space forbids a comprehensive analysis of military character here. It is sufficient to point out the need for its high development in all ranks and ratings, if we are to become fully prepared to meet the moral stresses of war. In our service proficiency on the part of our officers in this aspect of leadership is of particular consequence; on account of marked defects of military virtue in the proud, untamed, restless, self-willed national character of the typical American stock, as well as because of the great differences of character among the large groups of our unassimilated population from which the navy receives many recruits.

The military character of officers in the service of a democracy is of much greater consequence to the success of their cause, than in the service of an autocracy. In the latter case long years of class distinction, irrespective of individual character, endow the officer class with a prestige which facilitates greatly their psychologic control at all times. In a democracy the prestige of the officers inevitably must be based fundamentally upon their character. In their relations with the men democratic ideals and standards must be harmonized with the essential ingredients of military leadership. To some this may sound paradoxical; but it is not believed so. At all events it is an important problem for our officers to solve. We cannot accept the European or Oriental standards without important modification to suit our special case. On the other hand, some foreign services surpass us in some essentially democratic qualities, for example courtesy between officers and men; in these respects we can copy them with profit to ourselves.

The officer himself requires high military character, not only for its direct influence upon his personal military actions, but also because of its great value in facilitating his control over the military actions of his subordinates. The necessity for such control renders it more essential that the officer shall possess highly

developed character than those controlled should have, and requires further that he should possess certain attributes additional to theirs. For example his pugnacity, will power, and integrity obviously need to be greater than theirs, and he may require such qualities as dignity, poise and decision when they do not.

It is apparent that there is a very broad field for character cultivation and that it is an essential function of leadership.

LEADERSHIP PSYCHOLOGY

The control of men requires something more than high character in their leaders. There are occasions when control must be exercised in the face of underlying opposition among subordinates; at other times men desire to accomplish something which they are unable to do without the psychological assistance of good leaders—in crises the dependence of the mass upon leaders is well known to be very great—during tranquil periods the mass is often unable to overcome its own inertia.

Since the psychological side of men transcends greatly their mechanical side, inevitably psychology must be a conspicuous factor in leadership.

Until recently the word psychology suggested primarily such things as hypnotism, "black magic," spiritualism, etc.; nowadays in progressive circles it is regarded as a very concrete, practical, and highly important factor in any human activity of whatever nature, more especially where large numbers of men are involved.

There are certain perfectly sound and rational psychological principles, in no sense occult, which have a direct bearing upon the control of subordinates, under all circumstances of peace and war. The power of suggestion, the conditions under which it may be used advantageously, and the means for so doing, are but one aspect of this phase of leadership. Even such small matters as the tone of voice and the appearance of the eye may be of great value in utilizing suggestion.

Another phase is the great diversity of ways in which men may be affected by the complex feelings and emotions which largely govern human conduct. Let us consider, for example, the single case of the control of fear while in danger during periods of inactive waiting. Hocking has analyzed this situation, and advises the following "natural aids" to the individual:

1. Turn the mind deliberately to something in the region of habit; *i. e.*, to something in which mental control is certain and easy. For this a triviality of routine, such as adjustment of equipment, smoking, etc., is better than a thought demanding occupation.

2. Think of another's troubles; this will be a great aid to those possessed with a habit of unselfishness. Selfishness and sensuality predispose to fear.

3. Think of what you are going to do to the enemy—not what he will do to you. The most complete antidote to fear is pugnacity. Nature has made the organic base of the two emotions the same. General Grant was afraid of the enemy until it occurred to him that the enemy was equally afraid.

4. Recall first principles; that fear distorts the relative importance of things, and makes the possibility of personal injury loom bigger than the cause. Recall the philosophy of quieter hours; one's fundamental willingness to sacrifice, and why.

The same authority presents some valuable hints for officers in endeavoring to inhibit fear among their men.

1. *Personal Interest.*—Every man has a reasonable interest in not being forgotten, or being simply a bit of waste in the great scrap heap or war—anything that reminds him that he counts, and will not be lost sight of, will reach the right spot. A sign of personal interest will mean much.

2. *Mental Occupation.*—Aid the outward turning of their minds by giving then something to do while waiting. Call their attention to the small concrete duties that have become semi-automatic—the order of their equipment, etc. If circumstances permit their being allowed to fire, whether or not the firing will do much good, so much the better: whatever suggests doing things to the enemy will aid the turning of the bodily preparations down the pugnacity channel rather than the fear channel. Fear can better be met by substitution of alternative interest than by directly rebuking it and so recognizing and consolidating it, producing a division within the mind. It is here that "suggestion" has its place; ideas of action and success can be suggested.

3. *Do Not Minimize the Occasion.*—Fear will never be met by minimizing the occasion; this only drives it to deeper, more private and dangerous recesses. It is not incompatible with the suggestion

of success to prepare the men with the greatest candor for all contingencies, forestalling in this way the possibility of surprise, the greatest breeder of panic. An officer who has once concealed the worst facts from his command can hardly hope for their full confidence—an indispensable element in any power he may have over their fears.

4. *Avoid Extreme Measures.*—Be alert for the beginnings of agitation, hurry or confusion; slow the men down, suspend firing, or otherwise give them a chance to recover control. If you have to deal with an infectious bit of fear, avoid violent methods except as a last resort. Do not however use threat or bluster as a substitute for action; mean everything you say. Only remember that extremes, before extremes are necessary, are a confession of your own alarm, and make the case worse.

5. *False Heroism.*—Many men fear through a false conception of the nature of heroism; believing that it consists in an imprudent and irregular contempt of danger. This is enhanced by the general approval of occasional brilliant and foolhardy escapades. What the dare-devils do is often immensely worth while. But the men must learn that steady team work and strict adherence to orders are the basis of the courage that counts.

6. *Example.*—The most powerful means of studying men at a critical moment is the instant readiness of officers to act in contempt of danger; but the example of self-exposure will be powerful just in proportion as it has been kept in reserve, and so bears the meaning of a deliberate rather than an impulsive flurried act.

7. *Presence of Mind.*—Even in the heat of battle, that command of the head which can instantly bend every means accurately to the end, and in the most lavish spending still conserve—that presence of mind is the one supreme source of stability and control.

Fear is but one of a great number of emotions and feelings which must be combated or utilized if an officer is to get the best results out of his men under the almost infinite variety of situations presented by the circumstances of peace and war. A capable officer must be educated in the principles involved and practiced in their use. This is one of the most important elements of leadership.

MORALE

The cultivation of morale among the body of subordinates is another highly important branch of leadership psychology.

For many years our service was prone to take it for granted that our morale was satisfactory, to make no effort to elevate it, and to impose upon it so constantly as to keep it near the breaking point. The folly of this course fortunately is now recognized. Recently we have come to realize that morale is second in importance to no other factor in war—nor in peace time preparation.

This realization must ultimately result in creating the ability among our officer body to build and maintain morale. But at present we are deficient in this ability, and need to speed up the development of our proficiency in this respect.

There is not required in this paper any comprehensive treatment of the subject of morale. In an article published by the Naval Institute in 1916 ("Some Underlying Principles of Morale") the writer attempted to outline the constructive methods of morale building. A recent book by Professor Hocking entitled "Morale; and Its Enemies" contains much matter on this subject of great value to officers. Professor Royce's book on "The Philosophy of Loyalty," well known to the service, is very illuminating on the relation of loyalty to morale.

There probably remains a need to broaden the navy's conception of discipline; to lift it out of association with punishment and administration purely, and classify it principally in the realm of morale.

> If men are at odds with the general spirit or management of things; if they chafe under their rules or hate their rulers—whether the fault is in the rules or in the commanders or in themselves—the régime may bring out the worst in them rather than the best. External discipline, held in place by a vista of punishment, develops chiefly the powers of deception and evasion: makes adepts at beating the rules, and turns the times of freedom and furlough into times of kicking over the traces. And this will be to some extent the tendency of every system which pretends to a greater measure of infallibility than it actually possesses, or which assumes a military finality of form which it cannot make good in substance . . . . authority must be built on confidence and good will . . . . the obedience of the spirit is something which commanders have to earn.

HIGHER COMMAND

No conception of leadership would be complete unless it embraced the functions of the so-called "higher command"; including planning, strategy, tactics, grand logistics, and indoctrination. Here again we have been prone to consider these questions

primarily from the mechanical aspect, whereas experience during war has time and again demonstrated conclusively that the dominating factor in them, considered as a whole, is one of personnel.

By no means is it desired to minimize the great importance of these higher command functions; but since the service is coming rapidly to view them in true perspective, and since in the main the exercise of them concerns intimately but a small proportion of our personnel, they require no special comment in this article.

REMEDIAL MEASURES

If it be granted that the primary function of officers is to lead; and that the conception of military leadership formulated above is approximately acceptable; our need for remedial measures should require no argument. A few may raise the time-honored objection that "leaders are born," but a little reflection should convince even them that however great or small the inherent talent one may possess in any art, proficiency may be improved greatly by education and by practice according to approved methods.

When the young Naval Academy graduate reports on board his first ship, almost his first act is one of leadership; from then until the day of retirement the major activity of his professional life is leadership. If fortunate, he is "shipmates" with good leaders, and through their example may slowly learn much of the art. But good leaders, in a broad sense, are rare in the service, so that normally the young officer must rely principally upon trial and error, and frequently his proper development is retarded years through bad example.

Inevitably then, the need for knowledge of leadership is felt severely by the young officer at every turn on board ship. Pressing need for knowledge of any other subject is comparatively seldom felt. In seamanship, navigation, gunnery, and engineering, his duties are at first elementary, and his responsibilities slight. Mental capacity, with the aid of ship's libraries and associates, senior and junior, will serve him to master these if his previous education has been incomplete. Experience shows that however carefully his store of knowledge has been prepared at the Academy, such aids are necessary for the average officer as he advances in his career, and furthermore that inevitably he will become more and more dependent upon junior specialists, including

warrant and petty officers, for much technical knowledge and skill.

Dependence upon juniors for technical knowledge and skill has many disadvantages, and seriously handicaps the officer who carries it too far; but to some extent it is necessary, and its evils are immeasurably less than those resulting from dependence upon juniors for leadership. If officers cannot excel in everything, let them choose the lesser evil. In the navy of our late enemies, the Germans, it is said that the captains of the *U*-boats were not responsible for the safe navigation of their vessels; navigation being done, not even by subordinates of the line, but by warrant officers. The central idea in such a system is that line officers are specialists in leadership, and expertness in this art should not be jeopardized by requiring of them too much expertness in technical branches. This may be going too far in the other direction, but undoubtedly it has some elements of merit.

It is believed to be of the utmost importance that the education and training of our officers in leadership should be begun at the Naval Academy, with a comprehensive elementary course. Any suggestion to add to the Academy curriculum is nearly always answered by pointing out the severity of the present course, in proportion to the time available. The present course is undoubtedly excellent and none of it could be eliminated without considerable disadvantage. But the seriousness of omitting adequate ground-work in the basic branch of a naval officer's profession—leadership—appears to outweigh greatly the disadvantages that could result from the elimination or reduction of any other subject, without exception.

A somewhat similar course, perhaps more elementary, should be held at all schools for petty officers of the line, as well as at some of the schools for staff officers. It appears specially necessary that officers and petty officers at training stations qualify themselves in the theory of leadership; particularly in that branch dealing with instruction and training.

If the navy, like the army, should establish schools "of the line," intermediate between the Naval Academy and the War College, which appears most desirable, their curriculum should cover more advanced instruction in leadership, as a conspicuous feature of the courses. For the present at least, such instruction should be given at all the post-graduate special courses of the

existing system. Instruction in that part of leadership embraced in "higher command" will naturally fall to the lot of the War College.

Co-ordination between these various agencies of instruction is obviously in order to obtain a well-rounded education of our officers in this their primary function—leadership.

SUMMARY OF PRINCIPAL CONCLUSIONS

1. The principal remaining element requiring development, in order that our naval evolution may reach high and well-balanced efficiency, is leadership.

2. The primary function of naval officers is leadership; which embraces the operation of both personnel and matériel. Of these two the leadership of personnel is of superior importance.

3. Leadership of personnel includes:

I. Mechanical elements which facilitate interior co-ordination.
   (a) Organization.
   (b) Administration.
   (c) Instruction and training.

II. Psychological elements which give driving power to the whole organization.
   (a) Military character; particularly among the leaders.
   (b) Leadership psychology.
   (c) Morale; including loyalty and higher discipline.

III. Higher command elements.

4. Leadership of personnel should receive primary attention in the curriculum of every service school and college.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE SUBMARINE WATCH OFFICER

By LIEUTENANT L. J. STECHER, U. S. Navy

It cannot be repeated too often that the object of military and naval training in peace time is to prepare for war. War is our harvest time, and whether we reap richly or poorly depends largely on the intensity and quality of the training undergone.

But no matter how thoroughly and conscientiously we may have trained for, and studied war, in peace time, its final arrival will always reveal many a new lesson. Every new battle teaches us something, and the benefits from this should be twofold. The mistakes we made should teach us how to avoid them in the future, and through publication should serve to guide others.

But there are always some weapons in the art of war which are a departure from anything used before. The men in charge of these are then pioneers in their line, and have nothing in the way of the experiences of others to guide them. During the late war the submarine, perhaps, fell into this category more than any other innovation. And on board the submarine, the latest product is the submarine watch officer.

In pre-war days, submarines were taken less seriously, and they seldom went to sea for a period longer than two or three days. Consequently there was little necessity for any extra commissioned personnel to be used as watch officers. At the outbreak of hostilities, however, this was all changed, and many new, comparatively inexperienced, officers had to be ordered to this duty. Similar conditions will always prevail, and it is largely for the benefit of these inexperienced newcomers, that the following few remarks are set down.

The first thing that an officer must do when reporting to a ship for duty, regardless of the type of vessel, is to get acquainted both

with the ship, and the officers and men. This is particularly true on board a submarine. Every officer must understand not only his own particular duty, but he must always be prepared to perform the duties of every other man on board. Unless he can do this, he is not a qualified submarine man. As an illustration of the importance of understanding what one is about, the writer will cite an incident that was very close to becoming fatal.

The U. S. S. *A-5* was making a submerged run at various depths. The vessels of this class have only one main hatch, and the hatch is secured by means of a spindle clamp, which draws the hatch snugly against a large rubber gasket. The submarine changed depth from a periscope run to about 70 feet. At this submergence the great water pressure against the hatch compressed it tightly on the rubber gasket, and the spindle clamp became loose. An inexperienced reserve ensign in the boat saw the loose spindle, and, unobserved by anyone, tightened it. Then the *A-5* started on her rise to the surface, the pressure on the hatch becoming less, the gasket exerted a large pressure on the spindle and stripped the thread. Water immediately rushed into the boat, and it was only by the greatest of good fortune that the vessel came safely to the surface. This serious situation was caused entirely by the lack of complete understanding of a submarine by this officer.

Among the first things an officer should master is the construction of the ship. It is well to obtain a complete set of blue prints, and to study these carefully. In this way excellent information can be obtained regarding the construction of the hull, the arrangement of tanks, the lay of the pipes, etc.

When you have carefully studied the blue prints, you should go into the boat and trace out as many of the pipe lines as you can. Be sure you are able to pump, flood, or flow any tank into any other tank, or overboard. Do not hesitate to ask questions about anything of which you are in doubt. The longer you are aboard, the more you will be expected to know, and the more embarrassing it will be to have some one discover that there are some things about your boat that you do not know.

Having mastered the construction of the submarine, it is well that you then study its propelling machinery. Every one should know in a general way the limitation of a battery and something about its care and preservation. In the Battery Instruction Book

can be found some very useful information in regard to this. And as to the motors and engines, every one on board should be capable of operating both.

Then, having mastered all the foregoing, you are approaching the stage where you are becoming of some use to your commanding officer. He will assign to you some special departments, and about these you should know more than any one else in the world. A personal note-book, containing memoranda of repairs necessary, etc., will be of great value.

Equally as important as a complete knowledge of your ship, is a thorough understanding of every man of the crew. An officer should know them all by name and take a personal interest in their comfort. Make them feel that you have their welfare at heart. You cannot handle every man in the same way, and unless you understand how to deal with each individual, you will have trouble.

With the foregoing knowledge well under way, you will be prepared to take a watch at sea. In the war zone, standing a watch on a submarine is a very responsible duty. This is especially true when there are hostile submarines likely to be submerged in your vicinity. As an example the following is related. The U. S. S. *AL-4* was cruising on her patrol "billet" charging batteries, when on her starboard bow, at a distance of about 1000 yards, the officer of the watch sighted a periscope. He immediately made the "crash" dive signal and the submarine dived. Her hull had hardly settled below the water, when a torpedo from the hostile craft passed directly over her. Here the good eyesight, quick judgment, and proper execution of the correct procedure by the officer of the watch alone saved his vessel.

While on watch, you have under you the men on duty at the various stations. You should check the helmsman's steering and require him to make a half hourly comparison of the steering repeater with the standard compass. The lookout must be alert and, above all, know what he is on the lookout for, and what this will look like. The men in the engine room you cannot personally supervise, but you should find out who they are, and who is in charge. Ascertain whether the radio man is on watch as required, and that he understands his duty.

Next there is the vessel itself. The submarine must always be in readiness for a "crash" dive. This will require a frequent compensation for oil and fuel used. You should require regular

reports from the engine room, stating that this has been done. Remember which tanks have water, and how much, and which must be flooded in case of a crash dive. The torpedoes, being the submarine's most effective weapons, should be kept in a condition most consistent with their preservation and quick use. Regular reports from the torpedo room should be made, to show that the orders of the commanding officer regarding torpedoes are being carried out.

In attending all these important duties, the watch officer must not neglect to keep in mind the correct set of recognition signals. In the late war, perhaps the greatest single danger to a submarine was the difficulty of quick and correct exchange of recognition signals between friendly ships. Many examples could be given, but the writer will relate but one and that from his own personal experience. It took place on a stormy, dark night, when the visibility was very poor. While on watch on the U. S. S. *AL-1*, cruising on the surface to her patrol station off the coast of Ireland, he sighted the outline of a submarine. To all appearances it was an enemy vessel. Immediately orders were given to get the torpedoes ready and an attack was begun with full speed on the engines. Just before firing, however, a recognition signal was made, on the possibility that it might be a friendly boat. An immediate and correct reply was made by the challenged vessel and the attack was broken off. Had she delayed even so long as a minute, that minute might have caused her destruction.

A very important thing to observe is the constant readiness for a "crash" dive. Loose gear must never be kept on the bridge or one's person. The U. S. S. *AL-9* was cruising on the surface in a very heavy fog, when the fog suddenly lifted, and a large German submarine raider was revealed not 500 yards away. The signal to dive was given and the vessel submerged. In going below, however, the officer on watch got his binocular strap caught under the conning tower hatch. As the hatch went under, a stream of water rushed in, and it was necessary to come to the surface again in order to clear the strap. During all this time, the German raider was dropping shells all around, and it was only by the very best of good luck, and by the poor marksmanship of the Germans, that no shell found its way into the *AL-9* and sent her to the bottom.

Then, when submerged, it is always well for the watch officer personally to observe any order to flood or blow being carried out. The *AL-4*, in the war zone, was saved only by the bottom of the sea from never seeing daylight again, simply because when the order to flood adjusting tank was given, the man, by mistake, took hold of the auxiliary tank kingston lever instead. Had the water been deeper, the *AL-4* would have been lost. As it was, it took all the resource of the commanding officer and an hour's hard work to extricate her from the mud and bring her to safety.

Every vessel has her own peculiarities in the submerged state. These you must study and understand, always endeavoring to maintain the ship at the proper trim. When running a listening patrol, frequent stops are made, during which the operator listens in. During these times care must be taken that the vessel does not acquire too much upward or downward momentum. As the depth changes the rise or fall increases and is much harder to check.

In conclusion, the writer wishes to point out to the new officers the great importance of absolute self-reliance. In a submarine the officer on watch is virtually the acting commanding officer, and on him directly depends the safety of the vessel and the lives of the crew. Emergencies will arise that must be handled immediately. There is no time to notify the commanding officer. There will hardly be time for thought. To prepare most efficiently for such emergencies, picture to yourself as many as you can, and decide what would be the proper procedure. If in doubt, ask your commanding officer. Do all this while off duty. Then when on duty keep always alert.

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A TRAVERSE DIAGRAM

By LIEUTENANT L. V. KIELHORN, U. S. C. G.

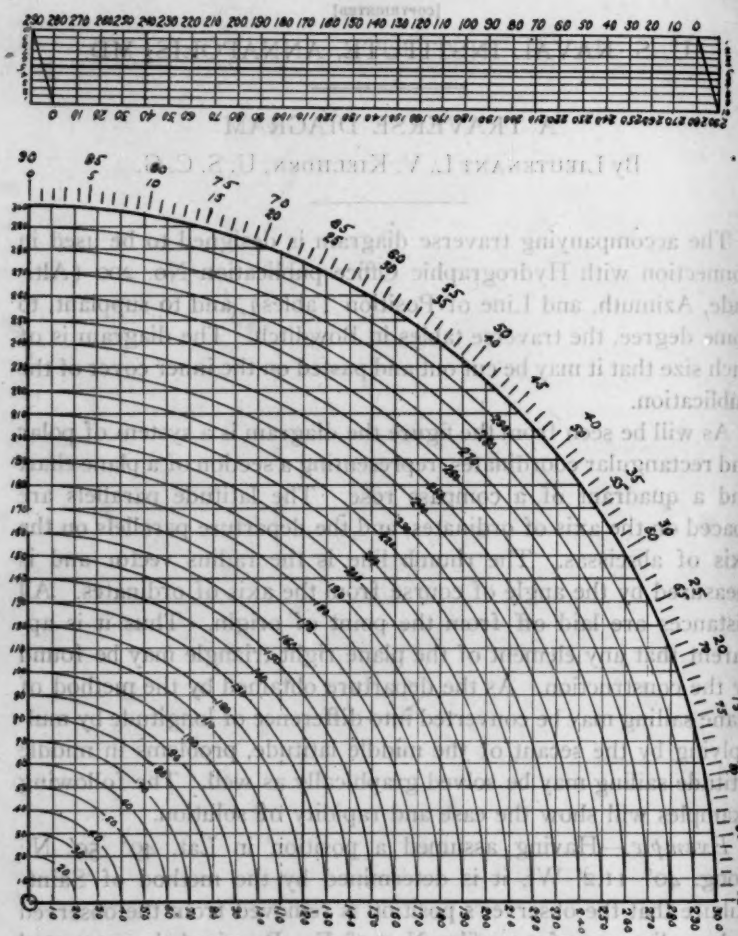
The accompanying traverse diagram is designed to be used in connection with Hydrographic Office publication No. 200 (Altitude, Azimuth, and Line of Position Tables), and to supplant, to some degree, the traverse tables in Bowditch. The diagram is of such size that it may be cut out and pasted on the inner cover of the publication.

As will be seen from the figure the diagram is a system of polar and rectangular coordinates, representing a section of a plane chart and a quadrant of a compass rose. The latitude parallels are spaced on the axis of ordinates, and the departure parallels on the axis of abscissas. The rhumb line is the radius vector and is measured by the angle of course from the axis of ordinates. All distances are laid off from the point of origin. Thus it is apparent that any element of the plane right triangle may be found by the construction. As the departure obtained by the method of plane sailing may be converted into difference of longitude by multiplying by the secant of the middle latitude, problems in middle latitude sailing may be solved graphically as well. The following examples will show the ease and rapidity of solution.

Example.—Having assumed a position in Lat. 49° 50′ N., Long. 40° 11.2′ W., it is determined by the method of Saint-Hilaire that the observer's position is removed from the observed body a distance of 9.7 miles N. 3.5° E. Required the computed point of the Sumner line.

Solution.—Lay off the course N. 3.5° E., and referring to the scale at the top of the diagram, step off 97 on the rhumb line from the point of origin. The coordinates will give at once a difference of latitude of 9.7′ and a departure of 0.6 mile. To convert the

departure into minutes of longitude, take the latitude (49° 50′) as the course and 6 as the difference of latitude, and the difference of longitude, measured on the rhumb line from the point of origin



to the intersection by the parallel of latitude 6, will be found to be 0.9′.

Assumed position:	Lat. 49° 50′ N.	Long. 40° 11.2′ W.
	D. L. 9.7′ N.	D. Lo. .9′ E.
Computed point of Sumner line:	Lat. 49° 59.7′	Long. 40° 10.3′ W.

Example.—A ship in Lat. 42° 30′ N., Long. 48° 51′ W. sails S. 34° E. 300 miles. Required the latitude and longitude arrived at.

Solution.—Turn the diagram to represent the southeast quadrant. Lay off the course S. 34° E. and step off with dividers 300 miles from the point of origin on the rhumb line. Using the scale at the top it will be found that the ship has made a difference of latitude of 249′, or 4° 09′, and a departure of 168 miles. Now take the middle latitude (40°) as a course and the departure of 168 miles as the difference of latitude, and the difference in longitude, measured on the rhumb line from the point of origin to the intersection by the latitude parallel 168, is found to be 219′, or 3° 39′.

Latitude left 42° 30′ N.	Long. left 58° 51′ W.
D. L. 4° 09′ S.	D. Lo. 3° 39′ E.
Latitude arr. 38° 21′ N.	Long. arr. 55° 12′ W.

Example.—A ship leaves Lat. 47° 18′ N., Long. 20° 10′ W., and arrives at Lat. 49° 57′ N., Long. 15° 16′ W. Required the course and distance made good.

Latitude left 47° 18′ N.	Longitude left 20° 10′ W.
Latitude arr. 49° 57′ N.	Longitude arr. 15° 16′ W.

D. L. $\left\{\begin{matrix} 2° 39′ \\ 159′ \end{matrix}\right\}$ N. D. Lo. $\left\{\begin{matrix} 4° 54′ \\ 294′ \end{matrix}\right\}$ E.

Middle latitude, 48° 38′ N.

Take the middle latitude (48° 2/3) as a course and lay off the difference of longitude 294′ on the rhumb line, and find the departure, measured on the latitude scale, to be 194 miles. Now lay off 194 miles as the departure and 159 miles as the difference of latitude, and through the point obtained by the intersection of the latitude and departure parallels, lay the rhumb line, from which the course is found to be N. 51° E. and the distance 250 miles.

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MORAL PREPAREDNESS

By LIEUTENANT ELLERY W. STONE, U. S. N. R. F.

> There is a tide in the affairs of men,
> Which, taken at the flood, leads on to fortune.
> *Julius Cæsar*, Act IV, Scene III.

As with men, so with nations.

The United States finds itself to-day at the end of the greatest war in the history of the world with a navy second only to one, in matériel and personnel. Its army as well stands at the height of its development. The nation has performed a glorious part in the conflict through which we have just passed. For the accomplishments of the past two years, then, we need have no regrets. It is the present and the future which now claim our attention.

So far as military preparedness is concerned, we are now, just as we have been at the end of every other war in which we have engaged, at the flood tide. And it is to our advantage, and our credit as well, that the present tide is of unprecedented height. Are we, therefore, to follow the advice of the Roman, Marcus Brutus, to adopt a national policy which will take advantage of the flood tide of our military strength, or are we to sit idly by and see it ebb away, leaving us stranded on the sands of unpreparedness?

In the enthusiastic flush of recent victory, the decision is, of course, obvious, but it should not be overlooked that *now* is the time for its execution.

During the 143 years of our national existence, omitting our difficulties with the Barbary States at the beginning of the last century and the Mexican trouble of 1914, we have been engaged in six wars. Even eliminating the Civil War as a primary internal affair, although as a matter of fact our foreign relations with certain powers were considerably affected thereby, we have been

at war with foreign nations five times, or approximately once per generation.

At the present time, the Covenant of the League of Nations is before the Senate for ratification. Whether it be accepted without change or with reservations, in either case we assume international responsibilities which will effectively prevent our returning to the insularity of the past. While the supporters of the League of Nations Covenant, as it was signed at Versailles, believe its adoption will eliminate the possibility of future warfare, the great powers do not appear to recognize such an eventuality as wholly negligible. Witness the projected defensive alliance between France, England and the United States, and the building programs of the navies of England, Japan and the United States.

There is also the possibility of complete rejection of the League. If this occurs, we shall either enter into a foreign alliance or proceed alone to insure the protection of the country and the safety and possession of our holdings overseas. Either course necessitates the protection of arms.

So that quite apart from any consideration, partisan or otherwise, of the desirability and efficacy of the League of Nations, with which this paper is not concerned, it does not appear that we should fail to concede the necessity for preparedness—a preparedness which shall not only make us victorious in war but victorious in peace—a preparedness which shall be moral as well as physical.

I have had the privilege recently of conversing with several ex-service men who have seen service in the Army overseas, in various ranks and ratings. I have been surprised—in fact, alarmed—at the mood in which they are returning to civil life. There seems to be an intense desire to be completely divorced from all things military. Although some of them have been offered commissions in the Officers' Reserve Corps, they have refused to accept them.[1]

[1] It should be remembered that in 1918, all commissions in the army of the United States, whether in the regulars, reserves or federalized National Guard, were changed to emergency commissions in the National Army. Consequently, officers not commissioned in the Regular Army are given the opportunity, when discharged, to accept appointments in the army reserve. In the navy, however, appointments were divided into three classes—regular navy, permanent; regular navy, temporary, and reserve. Appointments in the Naval Reserve Force are for periods of four years, consequently the release of naval reserve officers to inactive duty entails

When pressed for reasons for their refusal to further ally themselves with the military service of their country in time of peace, the answers were something after the following—too much politics dictating military policies, the Mexican border duty of the past few years, plenty of time when the next war comes, family comes first, and so on.

The antagonism, or perhaps I should say indifference, toward national service exemplified by the objections summarized above is not new. It is as old as love of country itself. But until we discount these statements, until we have refuted selfishness with patriotism, until we have instilled in our young an innate love of country which personal factors cannot weaken—in fine, until we have *moral preparedness*, our material preparedness will avail us nothing.

There are three points to be considered in this connection. With particular reference to the navy's needs, although the same factors and recommended procedure apply alike to the other branches of our military service; we must first build up the morale within the navy, both on active and inactive duty, we must keep alive the interest of civilians in military affairs, and we must properly educate our young.

Since, in the natural scheme of things, youth comes first, let us first consider the education of the coming generation.

One of the best proofs of the efficiency of the German military system was the manner in which its doctrines, to use a theatrical term, were "put over." From the time the German boy was first entered in school, the seed of militarism was nourished in the plastic mind of youth until by the time his scholastic education and military training had been completed, the plant was well rooted. And to insure its flourishing thereafter, a constant propaganda was carried on to reach and sway the man in civil life, with what results the world knows too well.

There is no reason, however, why such a campaign of education should not be adapted to more noble ends. The scheme lends itself of course particularly to the "old country." Prescience is more common a trait with your Britisher, Frenchman, or German than with the average American. We are more or less inclined to be

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at present no question of acceptance of new commissions, as in the army. The situation in which the navy will find itself at the expiration of these war time appointments, however, will be discussed later.

Wallingfords—we are apt to seek too early a return on our investments. We do not look far enough ahead into the future.

But since, if history repeats itself, we are to expect another war during the approach to manhood of the coming generation, *now* is the time to prepare for it. Let us energetically combat the indifference to those of their elders who place self before country, by carrying a nation-wide educational campaign of love of country, of patriotism, to the youngsters in our schools. This should not consist alone of prescribed flag ceremonies which tend to drift into a passive routine—it should include a forceful course of instruction designed to instil in every boy and girl that patriotism which which will put love of country before everything else.

This has been excellently accomplished at the national academies of the army and navy. It may be absorbed by the student from his surroundings quite as much as from any conscious attempt on the part of the instructors to impart that *esprit de corps* for which our military services are famed. But whatever the means, the end is certainly accomplished.

I recall hearing a friend of mine in a wardroom one day, a young lieutenant commander, in an argument with the paymaster. The latter was bemoaning—and well he might!—the scanty pay of naval officers, and threatening to hand in his resignation if it were not soon raised. Several officers present voiced the same views, but it remained for my friend to give us a lesson in loyalty.

"Well, 'Pay,'" he said, "you may say what you like about getting out, but I'll wager that once on the outside, you'd never be happy until you got back. My four years at Annapolis were hard ones, but I'm mighty glad I had them. From the time I came in as a plebe until I graduated, I was taught that that flag waving outside there was the only thing. I tell you it gets you! That flag comes first with me—before anything else. I know we ought to get more pay, but believe me, I'm in to stay!"

I think those of us who heard that brief, sincere, spontaneous expression of loyalty to the navy were immeasurably benefited thereby. It made more loyal men of all of us. If we can impart some of that patriotic Americanism to the minds and hearts of the youth of this country, we need never fear the enemy within or without.

Patriotism, like the other lofty emotions, is not easily defined. Some one has said that to analyze love is to defame it. I am not

altogether certain that an analysis of patriotism should not be similarly decried. Those emotions emanating from the heart are not easily laid open to inspection.

With its outward manifestations, however, we are familiar, and it is by teaching our young of the glorious accomplishments of our national heroes, in political as well as military endeavor, that we can hope to implant those seeds of patriotism which eventually will be the nation's strength and defence.

This may seem too idealistic to be practical, but as a matter of fact, there already exist channels through which this work may be carried on. For one, there is the boy scout movement. The scope of this organization is already nation-wide, in reality it is international, and it is rapidly producing for us young citizens of the highest character. Its very slogan, "Be Prepared," almost identical with the *"Semper Paratus"* of the coast guard, demonstrates its value to the cause of moral preparedness, for the boy scout, trained in mind and body to the service of his order and his country, will—in his later years—discharge the duties of citizenship with that appreciation of civic responsibilities which only such training can impart.

In addition, there have been established reserve officers' training camps and naval reserve units at various secondary schools and colleges. These serve to line up the boy to the service of his country at probably the most impressionable age, and their value cannot be overestimated.

Further, so far as the navy is concerned, the new Morale Division of the Bureau of Navigation and the Naval Recruiting Service are in a position to send out publicity to the national and state boards of education which will not only be valuable for recruiting purposes, but which, after due collaboration with the boards mentioned, can be made available for purely educational work of a patriotic and military nature.

I can recall that of the 11 years of my own primary and secondary school education in a city of average size, the existence of the national naval and military academies and the question of preparation for the career of an officer were hardly brought to our attention. Of actual life in the army and navy, we were equally ignorant. In college, such information as we obtained relative to the military services was due solely to the students' efforts. Surely there is room here for a campaign of enlightenment which, properly con-

ducted, will result in a wealth of active and reserve personnel for the army and navy which will make us not only a nation of healthy, trained citizenry, engaged for the most part in civilian pursuits, but able at all times to maintain the honor and territorial independence of our country and its possessions against any aggression.

If we can but train our young to something of the glorious ideals exemplified in the "Bushido" of the ancient samurai of Japan, we shall have a moral defence greater than all the armament our billions can buy for us. With the materials of warfare in the hands of young men so inspired, we may meet the future with that calm which only *complete* preparedness can engender.

Let us pass on to the question of the improvement of the morale of those at present in the service. Happily, a great deal has already been accomplished along these lines. Foreseeing the lapse of the voluntary aid from civilian organizations which the navy enjoyed during the war, the Bureau of Navigation has established a morale division, previously mentioned, to carry on this work. Its purpose is to maintain those moral and material benefits which the men received during the war, and it will tend, in no small degree, to keep an increasing number of men in the navy for reenlistments.

The question of adequate pay is also involved. This seems to be progressing satisfactorily—so far as the enlisted men are concerned—and should alleviate a great deal of discomfort and discontent on the part of the men and their dependents.

Due attention should be given to the instruction of the recruits at training stations along the line of patriotism previously set forth for the instruction of those in the public schools. The chaplains could well take care of this part of the recruits' training. Half-hearted measures, however, will not suffice. Unfailing reiteration appears to be the most successful method for imbuing the average young recruit with knowledge of any sort.

As for the morale of the commissioned personnel, surely it is enough to remember that "whoever is loyal, whatever be his cause, is devoted, is active, controls himself, is in love with his cause, and believes in it."

The future of the naval reserve force presents a problem which, properly handled, will prove of inestimable value to the service. The necessity for a reserve has long been recognized and has been authorized by legislation for several years, and it is

believed that its existence has been justified by the events of the war. If we maintain the present strength of the reserve force and replenish its natural depletions with the coming generation, we shall be in a state of personnel preparedness fully sufficient for the navy's needs.

It may be argued that the opinions of the ex-service men which I have quoted at the beginning of the paper are not truly representative of the entire body of ex-service men in general and of the naval reserve in particular. I hope they are not. But to insure this, it remains for the Navy Department to maintain the morale of the reserve in time of peace.

The majority of the enrollments in the naval reserve force will expire in 1921 and 1922. Unless the reservists' interest in the navy is maintained, they will not reenroll and the reserve will lose the services of these men and the benefit of the excellent training they receive in time of war, a training which cannot be imparted to those enrolling for the first time during the interval of peace.

It is true that under the impulse of war-time enthusiasm—and, for a limited number, we must admit, due to a desire to evade conscription—the naval reserve reached gratifying proportions during the war. The men so enrolled, however, were—for the most part—inexperienced in the duties which they were called upon to perform, and many valuable months were required to train them, to indoctrinate them with naval customs. It is not enough, then, for our citizenry to come to the country's aid only when war has been declared. Requisite efficiency can only be attained by maintaining a properly trained reserve in time of peace, so that the first few months of war, which are often of the greatest strategical and tactical importance, may be devoted solely to military operations and not absorbed in training routine.

A comprehensive plan is required, therefore, which will make the reservist feel that he is not forgotten, that the navy depends upon him to help keep himself in readiness for the service of his country. As suggestions, and merely to point out the trend of the project, it is recommended, for instance, that all reserve officers to whom are charged General Orders, Naval Regulations, etc., be supplied with the current changes and additions to same as issued to the service. In addition, their professional training should not be neglected. ***Correspondence courses should be maintained for all reserve officers,*** according to the classes of the reserve in which

they are enrolled and the nature of their respective duties, *i. e.*, deck, engineering, aviation, communications, and the various staff corps billets. This work might be brought under the scope of the Naval War College.

Such a procedure will not only keep the officer abreast of the times in his profession as a reserve naval officer, but what is equally important, it will never let his interest in the naval service lag.

If state universities can afford to maintain extension courses for the benefit of the student alone, surely the navy, which will realize the greater profit, can afford to do as much for its reservists.

The Naval Institute can also do its share in this work. By employing the Navy Register as a directory, large numbers of reserve officers can be reached and brought within its membership, whose professional value to the service will be increased by the monthly arrival of the PROCEEDINGS.

A similar plan can be worked out—with modifications, of course—for the enlisted personnel.

Over a year elapses before the first enrollments expire. Now is the time to seize this opportunity! Let all of us, who have the interest of the navy at heart, combine to so win the allegiance of the reservists to the naval service that when their enrollments expire, they will feel that reenrollment is as much a part of their duty to their country in time of peace as active duty is in time of war.

The close of the war finds us prepared with an organization equipped to carry on this work. Let us utilize it to build up a moral preparedness which shall be a fitting counterpart of the material preparedness of our building program.[3]

Let us now approach the third aspect of the situation, the relation of civilians to military and national affairs.

We have seen how the ex-service man rebels against what he believes to be the political exploitation of the services. Of course,

[3] It is a pleasure to be able to record that since the above was written, September, 1919, the Bureau of Navigation has issued its regulations governing the "brigade unit" administration of reserve personnel, confirmation of officers, and the designation of an annual Naval Reserve Day. While the technicists of class four, who are civil and electrical engineers, etc., in civil life, do not feel that proper provision has been made for them as yet, these regulations as a whole will certainly enhance the morale and efficiency of the reserve force.

in the broad sense of the term, the military will always be ruled by the political in any democracy. War itself is a political act, carried on to effect a political end which statesmanship has failed to secure. It is "politics" in the narrow sense of the term to which objection may rightly be taken. The military services should never be subjected to a political control which is partisan in its nature.

If we admit for the sake of argument that party politics have been allowed to dictate our military policy, what is the remedy? Surely we are not improving matters when we evade our duty to the country. It is that very shirking of responsibility for which the national parties themselves are censured. My advice to the ex-service man who may be disappointed with military and political conditions is not to refuse the duties of citizenship. The cure cannot be effected from the outside—the remedy must be applied internally. Sims did not resign from the navy because he disapproved of its gunnery methods. He improved the condition which he recognized as faulty by devoting his efforts and services to that end. If reforms are to be secured, they require positive action—not negative.

If party politics are not what they should be—how shall we attain that purity of national temper which will put *country* above all else, which will be in itself a moral preparedness for peace as well as war? The answer is that all those who have seen the vision—those to whom military service of their country has taught a new love for the flag, a new allegiance to that which it represents—should take up the duties of political life.

Hundreds of thousands of men are now being returned to civil life who have fought the fight, whose daily association with the colors has taught them, sometimes unconsciously no doubt, a new love of country. Let us interest ourselves more keenly in politics. Let us not be satisfied with the manual performance of citizenship on election days. If we are not in a position to enter active political life ourselves, let us be assured that our representatives to come will be those with whom we served in the war. We depended on them in the army, in the navy, in the marine corps; we can rely on them in our legislatures—state and national. When service appropriations are necessary, when military legislation is to be enacted, they will not forget the days of 1917, and, being

members of the military reserve—as I hope a large proportion of them will be—they will appreciate the fact that an officer appearing before a congressional committee on military or naval affairs does not represent a military bureaucracy, but is, like themselves, in the service of our country.

If such future statesmen discharge their civil obligations to the nation as well as they have recently performed their military duties, we need entertain no apprehensions as to the degree of our moral preparedness.

Here is educational work for the American Legion, the Military Order of Foreign Wars, and our other patriotic societies, founded on military service. Those of their membership who object to active or reserve military service in time of peace on the ground of family reasons should be made to realize that it is the nation itself which guarantees the sacredness and inviolability of family relations, and that those who refuse to enroll in their country's service can hardly claim the right to its protection.

To the pacifically inclined, this paper, in its advocation of certain military precepts, may seem too bellicose in tone. I would remind them that the most noble characters in history are those who have used their strength to maintain their own honor, to protect the weak. The greatest single military force of the late war, the British Grand Fleet, whose Sixth Battle Squadron comprised ships, officers and men of our own navy, by practically the mere fact of its *existence*—the " sea power " of Mahan and Colomb—prevented the bloodshed which would have followed a German invasion of England and the United States.

Brutality is not strength alone, but strength directed by wrong moral concepts. Militarism, in the objectionable sense of the term, is not necessarily embodied in material preparedness unless the latter be wrongly employed. Let us now, at the moment of our greatest military preparedness, which can without difficulty be maintained, by the universal education of our citizens, young and old, strive to develop a moral preparedness which shall be the righteous directive force of our physical strength, which shall stand for all that is highest in our national existence, and which, if the need comes, shall be the rallying force of a loyal, trained citizenry to its nation's defence!

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN IMPROVED TOWING SPAR WHICH CAN BE USED AS A NAVIGATIONAL INSTRUMENT

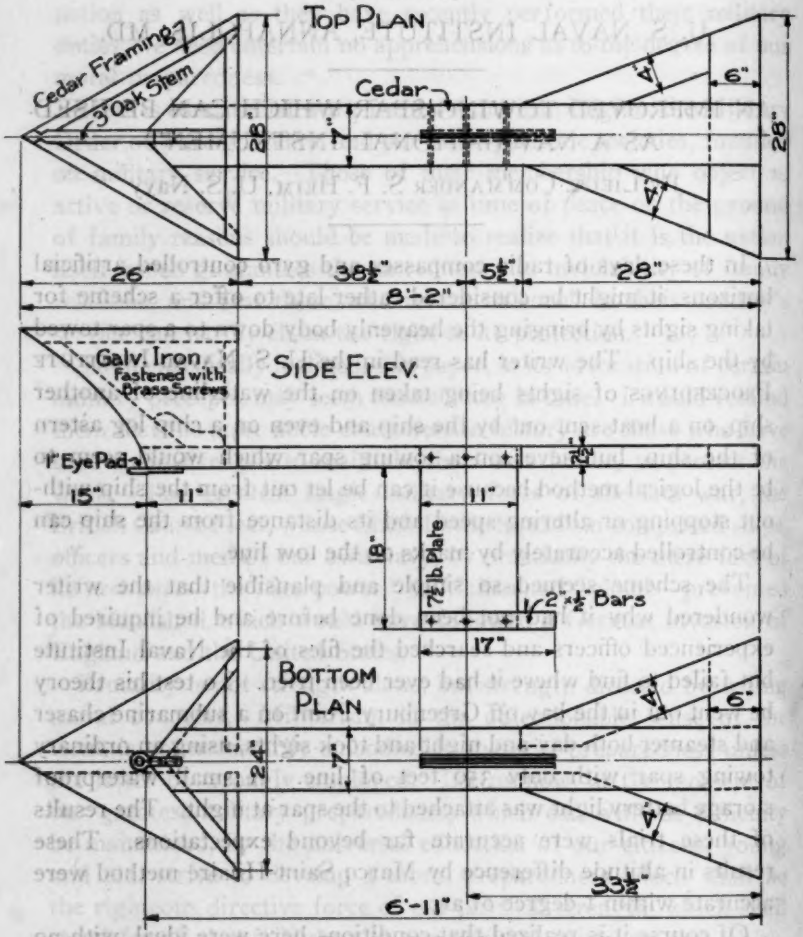
By Lieut. Commander S. F. Heim, U. S. Navy

In these days of radio compasses and gyro controlled artificial horizons, it might be considered rather late to offer a scheme for taking sights by bringing the heavenly body down to a spar towed by the ship. The writer has read in the U. S. Naval Institute Proceedings of sights being taken on the waterline of another ship, on a boat sent out by the ship and even on a chip log astern of the ship, but never on a towing spar which would seem to be the logical method because it can be let out from the ship without stopping or altering speed and its distance from the ship can be controlled accurately by marks on the tow line.

The scheme seemed so simple and plausible that the writer wondered why it had not been done before and he inquired of experienced officers and searched the files of the Naval Institute but failed to find where it had ever been tried. To test his theory he went out in the bay off Greenbury Point on a submarine chaser and steamer both day and night and took sights, using an ordinary towing spar with only 350 feet of line. A small waterproof storage battery light was attached to the spar at night. The results of these trials were accurate far beyond expectations. These results in altitude difference by Marcq Saint-Hilaire method were accurate within 1 degree of arc.

Of course it is realized that conditions here were ideal, with no wave movement of either the spar or the ship; but it is proposed to eliminate these errors as far as practicable at sea by use of the improved towing spar which will remain afloat with 500 or 600 yards of line out from the ship. The longer the length of line the more accurate will be the results. The maximum possible error

due to rising and falling of spar in sea will be the angle with tangent equal to maximum rise divided by length of tow line. Thus with a 3-foot rise and fall of spar with 600 yards of line the maximum error would be 5 minutes in altitude.



TOWING SPAR U. S. S. "CHARLESTON."

The three views of the towing spar are self explanatory and a description is unnecessary. This spar was developed and used by the commanding officer of the U. S. S. *Charleston* while engaged in convoy duty during the war. The old navy towing spars and special sheet metal tank spars supplied to ships were useless

for this work because they would tow under at the distances at which they were desired to be used. The towing under was caused by two things: their shape and the towing line. The improved spar shown in sketch was towed by a small wire rope of about the diameter of a lead pencil. This wire line was wound on a small reel secured just forward of the quarterdeck winch. The spar was hauled in by means of the deck winch. It was found that manila line was unsatisfactory for towing spar work because the water-logging and friction tends to pull the spar under. It will be noted that a strong keel or centerboard is attached to the spar. This is an important feature which causes it to tow during turns and prevents capsizing.

It is believed that a towing spar of this kind, fitted with a fine wire rope towing line and with an attachment for securing a small storage-battery light for night work, would be under many conditions a valuable asset to the navigator.

By having at hand a table of "dips" to use for different speeds and lengths of tow line, the operation of taking a sight would be comparatively simple. He could take the bearing of the heavenly body to be observed and then head the ship directly away from the body and with spar out take a series of sights. The average of the series should be taken to counteract the errors due to wave heights of the spar. By practice in fair weather when the "dip corrections" are computed he could determine the limits of accuracy and how much confidence to place in it when occasion for its use arrives. We have all experienced the occasion when a sight was highly desirable or even necessary with the sun out or stars shining but no horizon visible.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A NAVY SUPPLY DEPARTMENT IN WAR TIME

By COMMANDER G. P. DYER, Supply Corps, U. S. Navy

It would easily be possible to prepare a volume on the subject allotted to the writer by the Naval Institute, embracing many technical amplifications and variations in storehouse practice which the war developed; but for the general circulation of the Institute it will undoubtedly be better merely to give a few interesting statistics and to touch on the salient and not altogether expected changes which the advent of actual war conditions required.

It was his good fortune as supply officer of the Norfolk Yard to fall heir to an excellent organization, and therefore to be in position at once to develop further its possibilities rather than to have to waste precious time in rebuilding. His predecessor—one of the most able and devoted officers in the supply corps—had been in charge since early in 1913, so that it had the advantage—besides its most capable administration—of a long-continued development and training under a single policy. A similar continuity of control had existed in the industrial department of the yard, with which during the entire period of the war, as well as before, the most satisfactory relations of comity and cooperation existed. This factor, coupled with the active and sympathetic direction of the commandant, conjoined to put the supply department in a position to devote its whole attention to the business in hand of helping to win the war with the minimum of lost time and lost motion.

Before the war this department consisted of approximately 66 clerks in the office, 36 storemen, and strength of laborers averaging 115 men. At the height of war activity, including reserves as well as civilians, these forces were expanded to approximately 500 clerks, 700 in the storehouses, and from 1800

to 2500 laborers. As can be appreciated, this expansion would have been wellnigh impossible had it not been for the availability of naval reserves, both men and women. Unlike commercial concerns who saw their most active men drafted without chance of properly replacing them, the navy yards, while having the same vacuum process applied to their employees between the ages of 21 and 30, were able to fill the void from the military organization of the navy. The civilian personnel which remained after the processes of the draft had been completed furnished the experience in routine methods vitally needed to keep the organization going, besides their current work loyally helping to train the large number of inexperienced people taken on.

A simple table of figures will show the volume of work thrown on this department during the war, but before setting it down a few words of explanation are relevant. While nearly everybody recognizes that the navy achieved almost a miracle in the transport and supply of an army of 2,000,000 men as well as its own naval forces overseas, not everybody realizes just what this involved in physical terms. In order to furnish its supply service alone (a) needs had to be estimated, (b) the stores obtained from the readiest sources, (c) when received had to be checked and settled for, (d) put in such systematic arrangement that they could be found instantly on demand, (e) and when demanded, issued with the utmost expedition. In considering these figures it should be remembered that in addition to the yard's own large industrial requirements, this department supplied all navy operated vessels passing in and out of the capes of the Chesapeake, and the main battle force continuously stationed in the York River. This fleet consisted of maxima of more than 50 battleships and other war vessels at Yorktown, of 56 troop transports with their headquarters at the Newport News embarkation point, 110 cargo carriers operated from the Norfolk branch of the N. O. T. S., innumerable small naval craft, and visiting men-of-war and merchant ships not only of our own but of allied nations. In addition, Norfolk, having acquired large quantities of stores and secured in the neighborhood of the yard a large increase in its area for storage, became the main distributing point for many items, and had to take care of heavy domestic shipments. The numbers of different ships and stations supplied during the months for which these figures were kept, and the numbers of items sup-

plied to them have been chosen as probably the briefest and most comprehensive index of the magnitude of this business.

Month	Number of items supplied	Number of different ships and stations served
August, 1918	83,662	1035
September, 1918	67,366	679
October, 1918	75,092	955
November, 1918	54,220	812
December, 1918	50,635	878
January, 1919	50,935	465
February, 1919	41,604	476
March, 1919	24,370	528
April, 1919	24,600	375
May, 1919	26,227	307
June, 1919	20,211	306
July, 1919	18,630	187
August, 1919	15,093	137

Although exact data are not available before then, the peak of the load occurred during August, 1918. As shown in that month, 1035 *different* ships and stations were served 83,662 items; practically 2700 items a day, Sundays included; or 114.5 for every hour night and day during the month. Truly astonishing figures. These items ranged, of course, from small mail packages to huge deliveries such as a thousand tons of pig iron in one lot for ballast. Some of this thousand odd ships—like the vessels at Yorktown—were served many times over. To those acquainted with the considerable distances between outlying depots, bases, anchorages, and piers in the vicinity, it will not be hard to realize that it took a fleet of seven steamers, 10 tugs and about 40 lighters and barges to accomplish local deliveries, aside from the floating equipment needed to take care of deliveries to nearby commercial connections for receipts into and shipments away from the yard.

All of this work was done with a remarkably small percentage of failure or error. Day after day would go by registering the issue of more than 3000 items, with a "stock exhausted list," that is, a list of the items called for which could not be supplied, of less than 75. This indicated an effective delivery of better than 97 per cent of the items called for. When it is considered that the stock comprised more than 21,000 active items and about 9000 special and obsolete items, this attainment seems almost incredible.

It would not have been possible perhaps, but for the genuinely patriotic fervor with which—almost without exception—the force worked.

As not unusual incidents in the day's business, the following may be cited:

The U. S. destroyer *Radford* was delivered to the yard from the builders at 2 p. m., September 28, 1918. Her allowance list of equipage and supplies called for approximately 1800 items. She was furnished these items with the exception of 25, and was reported as completely outfitted by noon, September 30, 1918.

The supply officer was informed on the afternoon of October 9 that the *Baxley,* just received by the naval overseas transportation service, would require practically a complete outfit. Requisitions were submitted and the first issue papers based thereon reached the storehouse at 7 p. m. on the 9th. These requisitions covered a total of 1412 items, 1348 of which were filled from stock and 64 were not filled. The *Baxley* began loading the stores on the morning of the 10th, and at 3.30 p. m. on the 11th, was reported as having received her outfit. She sailed at 5 p. m.

Measures extraordinary to peace time were obviously necessary to accomplish these feats. Soon after the arrival of the writer it was apparent that in order to fulfill the ideal which the supply department strove to attain, of delivering all items on any accredited call to the place and at the time desired, it would be necessary to work day and night. Three eight-hour watches were established in the storehouses, which were thereafter continuously open for business, Sundays and holidays as well; so that any ship might have her needs filled at any hour. Two watches were found sufficient for the office forces, *i. e.,* from 8 a. m. to 11 p. m., in order to keep up the flow of papers. Watches were "dogged" every week so as to distribute the night work. This innovation was cheerfully borne by practically everyone, although it involved odd hours for all, and required women to report sometimes at 7 a. m. and did not release them at other times until 11 p. m., which was particularly hard on account of the congested conditions in the locality and the resultant broken-down transportation service. One of the most inspiriting experiences of the supply officer during those punishing days was his nightly tour of the storehouses, towards 10 or 11 o'clock, when the swirl of the day's business had somewhat subsided in his office, to note the hum of orderly ac-

tivity in them and the constant stream of supplies, which had cost so much labor to procure and store, travelling from their departments through the packing division to the trucks waiting to carry them toward their destination; or to visit the freight house, where stores for outlying points were collected and conveyed under the glare of electric lights to the waiting steamers and barges continuously being loaded. The general storekeeping system—installed to render uniform and impartial stores service to the navy as a whole—and developed through all the subsequent years of travail by many brilliant anl loyal supply officers was at last meeting its real test—and meeting it successfully.

One of the chief lessons of those days was the hammered-in conviction that only by the employment of such a rigid system rigorously adhered to can a supply service stand a strain, like that war, without breaking. This may seem axiomatic, but no one unacquainted with such a business can appreciate the temptation to handle special calls in a special manner. Each commanding officer, very properly, is anxious for special service for his particular ship. If he succeeds in interrupting the orderly flow of all material to all ships he is almost sure to sacrifice someone else through breaking the stride of the activities involved. Where everyone is trying to fill all demands as expeditiously as possible, it is far better to let each requisition take its course than to try to give it preference. This rule, in practice, is subject to some exceptions, but they should be as few as possible. It does not imply that a special corps of follow-up men is not advisable, to insure that any unusually important item is being taken care of, but it does mean that except in very extraordinary circumstances no requisition should be taken out of its place in line at any stage of its progress.

One of the most successful ideas born of war conditions was the creation of the "ship's representative." To the ship's representative was given the duty of checking up and following through all outstanding items for ships. He was instructed that he was to act as the critic of the Supply Department and as though each ship had sent him to the yard as its representative, to see that the Supply Department delivered the goods in the minimum possible time. He had the advantage over an officer or man actually sent from the ship, in being thoroughly acquainted with the yard, office, and storehouse routine, and could prosecute his investigations and inquiries with the least possible disruption of current work. He

maintained a "due" index of all items not immediately furnished from stock and secured a "promise date" from the activity concerned, either with its purchase, manufacture in the yard, or procurement from another yard, as to its arrival. These promise dates were arranged in a card index chronologically, and as they came up were investigated to see whether the item had been delivered as promised, and, if not, what the trouble was. Ships were advised of the telephone number of this representative and that they were free to treat him as their own agent in making inquiries for stores. This activity grew to require quite a corps and amply proved its usefulness in increasing the accuracy of the service to ships in picking up promptly items which for one reason or another had gotten sidetracked or required special interest and action to secure delivery.

Another innovation in storehouse methods which the increase in business required was the system of direct delivery to vessels in the yard. It was found that the old method of requiring these vessels to send working parties for their stores, produced such confusion in the storehouses as seriously to interfere with their work. Accordingly, arrangements were made to deliver to the gangways of the vessels concerned, in the same way as delivery was effected to vessels lying at berths beyond the yard limits. The duties of the conductor of this delivery service were amplified to provide port information to incoming ships, many of whom were strange to local conditions. Perhaps the insertion here of the standing orders to this conductor will be as interesting a way to describe his duties as any other:

From: Supply Officer.

To: Conductors of trucks for delivery of stores to ships.

Subject: Procedure to be followed in delivering stores to vessels at the Yard.

1. On arrival at the ship, ask for the Officer of the Deck. Tell him that you have stores from the yard for delivery to the ship. Ask him to direct you to the Supply Officer of the ship. If the Supply Officer is not on board, ask to see the acting head of the Supply Department. Tell him that you have stores for the ship and are under my instructions to arrange for their immediate delivery.

2. Unless the stores are accepted for delivery with reasonable promptness, see the Officer of the Deck and ask him to direct you to the Executive Officer of the ship. Tell the Executive Officer that you are under instruc-

tions to make prompt delivery to the vessel and ask him to arrange therefor. He will understand that in order to facilitate the system of direct deliveries to ships—in place of requiring the ships to send for their stores—it is necessary to release the motor equipment of the yard as promptly as possible after arrival at the ship's side, in order to serve all vessels required, without waste of trucks.

3. If when you have followed the procedure above, you are informed by the ship's Executive Officer—or Officer acting as executive—that it is impossible for the ship to accept delivery at once—return the stores to Storehouse No. 15 and inform the Supply Officer by written memorandum as to efforts made by you to secure delivery and the circumstances preventing your doing so.

4. If necessary, to make the situation clear, exhibit this order to the Executive Officer of the ship.

Approved: By the Commandant.

From: Supply Officer.

To: Conductors in charge direct deliveries to ships.

Subject: Additional orders.

1. It shall be your duty to visit all vessels as soon as possible after their arrival at the yard, for the following purposes:

(a) To inform the ship's Supply Officer, if necessary, of the yard's routine for direct deliveries to ships.

(b) To deliver to him any copies of current contracts or information sheets which may be necessary to advise him fully as to local conditions concerning which he may need information.

(3) To convey to him the Supply Officer's urgent request that, to secure the best service with the present volume of business in the storehouse, it be advised of the ship's requirements in all departments as the earliest possible moment. The surest way to get stores is by direct delivery while at the yard.

(d) To suggest the use of ships stub requisitions wherever practicable, and in this connection, to indicate that the Supply Department maintains a Bureau of Information in Storehouse No. 15, where desk room, typewriters, a stock catalogue, blank forms and persons to indicate how items on stub requisitions should be segregated, are available.

2. No more time will be occupied with these visits than necessary; and under no circumstances will you be permitted to conduct investigations or execute commissions on behalf of the ship not within the scope of this order, the intent of which is that you shall give port information pertaining to Supply Department business only, or make a delivery, and depart as soon as possible.

3. To effect the above as quickly as may be, show this order to the Supply Officer, or acting head of the Supply Department, when practicable.

Approved: By the Commandant.

These orders indicate that a Bureau of Information was established. This, so far as known, was new also to storehouse practice. It proved of the greatest help to both vessels and yard. A man with a general knowledge of stores in the yard and of storehouse methods was put in charge of this Bureau with several people under him. Stock catalogues, a supply of requisition forms, and several desks for the use of visitors were provided. This office was constantly thronged with persons making preliminary inquiries before submitting their requisitions and proved of particular aid to inexperienced officers especially on small craft, who were helped to put their requisitions into proper form and, by the use of stock numbers, to get exactly what they wanted. With the use of ships stub requisitions it was possible for the commanding officer of a subchaser, for instance, going to this Bureau with the vaguest possible idea of how to get what he wanted, or even of what he wanted, correctly to prepare his requisition on the spot, present it to the storehouse and have it honored very much as he would have made a purchase in a city department store.

Office routine has been practically worked out and prescribed by regulation, but that of the storehouses still remains largely dependent upon the policy of the local supply officer. The preparation of the standard stock catalog gave the key to the arrangement of stores at Norfolk. The usual system of storing by classes had been carried out before the war to the remarkable details of storing practically all items in each class in sequence by stock catalog numbers. It was thus possible, as proved by actual experiment, for a person entirely ignorant of stores, say a messenger boy, to be given a stock catalog number and told to fetch one of that item. By consulting the general layout plan of storehouses he ascertained in which building the class indicated by the stock catalog number was contained. He went to that building, where conspicuously hung signs confirmed the location of the class. He followed the alphabetical index of the items through the bins until he came to the number under that letter in its proper place, and without knowing the appearance of what he was sent for, would bring back the item desired. With such a system of storage as this, even the men and women ignorant of naval stores who came into storehouses to augment its peace-time force were able to attend to business almost immediately. The issuing papers pre-

pared in the office showed the stock catalogue number (or the special stock number) of the item, and it only remained to fill them from the issue bins containing those numbers. Of course, the supervision of experienced storemen was necessary, but the point made is that the detailed systematic arrangement of stores prior to war enormously facilitated their issue when war conditions came.

The replenishment of the issue bins as well as the accuracy of issues from them was much helped by the use of standard stock samples. These samples were securely fastened at the same location in each bin so as to make accidental removal impossible. A stock tag bearing the stock number and the proper nomenclature of the item was secured to the sample. If any care at all was used, it was therefore impossible to refill a bin with material differing from the sample plainly exhibited in it or to issue a different item from it. This device alone undoubtedly prevented numerous wrong issues, especially on the part of inexperienced people. It also automatically brought to attention errors in the procuring and inspection as well as the storing of stock. What these errors might have been may be judged from the fact that during last summer and fall an average of nearly sixty carloads a day of supply department material was received, unloaded, inspected and put in stock—aside from large receipts from water carriers.

One naturally might wonder how this flood of incoming material could be segregated so as to be accessible. Surely no system of issue bins could take care of it. Of course not. A system of "overflow stocks" was necessitated for bulk storage, to act as a reservoir for the issue bins.

The navy "classes" of stores were found so numerous as to be unwieldy. Borrowing an idea from the big mail-order houses, these classes were aggregated into 14 "departments," generally corresponding in scope to the separations of goods in commercial practice. For example: Department "J," which embraces classes 18, 35, 36, 54, 53, and 57, is practically a stationer's shop, and Department "E"' including classes 10, 11, 13, 32, 33, and 60, an engineering supply house. Managers were detailed for each of these departments and made responsible not only for their condition, but for the knowledge of what they had both in issue and overflow, and in the case of the latter just where it was stored. In some cases these managers were exceptionally competent persons who practically assumed entire direction of the custody

and issue of stores in their departments as well as furnishing valuable advice to the stock upkeep section as to replenishment. A civilian general manager of the storehouses insured co-ordination and standardization amongst the different departments.

Undoubtedly this plan of departmentizing the stock is the proper one for a large storehouse. With competent, *i. e.*, sufficiently high-priced persons for department managers, the routine of custody and issue once established will be carried on through this organization most effectively. No one person or office working through low-priced storemen can insure the regular observance of the proper routine throughout a big establishment. It is necessary to divide up the work. The present difficulty is to procure a sufficiently able corps of department managers, with the limited inducements which can now be offered.

The control of the large laboring forces employed had to be subdivided in the same manner. An officer was made labor and transportation supervisor. Under transportation his duties included the direction of a fleet of about 40 yard motor trucks, assigned to the use of the Supply Department. The yard with its annexes was then divided into zones each in charge of a quarterman, who was directly responsible for the use of labor and of motor equipment in his zone.

With the responsibility of directing a business of this size, it became obvious that some system of securing a bird's-eye view of its daily operations must be installed for the information of the Supply Officer. Individual oral reports took up too much time; and yet he must know in considerable detail how the various parts of the great machine were functioning. The idea for accomplishing this was stolen from Sir Eric Geddes who was reported as controlling his combined activities as a general in the army and an admiral in the navy through a system of curves plotted on cross section paper, which indicated the progress and the daily state of the various units under him. The most important activities in the Supply Department were accordingly pictured by such curves produced from brief daily written reports. These plots conveyed information at a glance as to whether any part of the organization was improving or falling behind in its work.

For convenience overflow stocks were divided into "first" and "second" overflow. Wherever possible the first overflow was located adjacent to the issue bins. Where this was not practical it

was kept as near to them as might be. In this overflow was carried a small number of unbroken packages of each item necessary, and the issue-bins were normally refilled from it with the least possible loss of time.

The second overflow consisting of the bulk storage of items, on account of lack of space, had to be stored usually at some distance from the issue storehouse. This material was always stored by departments, however, with every package marked with its stock number before it was piled. Department managers supervised this stock and saw to it that their first overflow was replenished from it as required. The second overflow thus bore the relation of a wholesale department to the retail department in the issue storehouse.

The fortunate position of the Norfolk Yard as the only large and centrally located yard on the Atlantic Coast which had vacant and inexpensive land abutting it suitable for storage requirements soon made it the general distributing point for many items. When the writer arrived at the yard he found practically every square foot of ground under navy control congested with stores. The only available method of increasing the capacity of this area was to pile higher and higher. This meant a greatly increased cost of handling. With the knowledge that great quantities of stores were yet to arrive it was obvious that more space was necessary. An inspection of the neighborhood revealed a tract of unimproved property adjacent to the yard, which was susceptible to quick development for storage purposes. Unhampered by existing improvements or by the necessity of providing for other than supply activities, its layout could be perfected to accord with modern storage ideas. Accordingly the authority of the department was secured to commandeer the land primarily for the purpose of storing lumber, and on the first of June, 1918, ax was put to the first tree in this wilderness. Fourteen months later on this tract there were eleven large temporary storehouses (two of them 780 by 250 feet each) covering with a roof a total of nearly 13 acres, office buildings, barracks for the necessary police guard of 90 marines, about 50 acres of fully equipped open storage space, nearly eight miles of storage and communication railroad track, and a similar length of paralleling wagon road. On this area more than 12,000 carloads of material had been placed under cover and open storage. Forty-nine million feet of lumber had been

unloaded, segregated and piled on this ground. Other items in quantities undreamed of by the navy before the war found rest there in orderly arrangement.

The great expansion of the Supply Department forces and the introduction of reservists has been referred to. The writer must bear testimony to the general excellence of the reserve officers under him, who at one time numbered 35. Their inexperience in the particular work assigned them was of course a handicap, but their devotion and energy made good this lack so far as possible. As an instance of his trials arising from the introduction of so many inadequately trained people, the following memorandum is quoted, which after its circulation settled a difficulty which he had encountered, particularly with relation to the many attractive young women in the department.

PRIVATE MEMORANDUM FOR ALL OFFICERS

"It is by no means enough that an officer of the navy should be a capable mariner. He must be that, of course, but also a great deal more. He should be, as well, a gentleman of liberal education, refined manner, punctilious courtesy, and the nicest sense of personal honor.

"He should be the soul of tact, patience, justice, firmness and charity. No meritorious act of a subordinate should escape his attention or be left to pass without its reward, if even the reward be only one word of approval. Conversely, he should not be blind to a single fault in any subordinate, though at the same time he should be quick and unfailing to distinguish error from malice, thoughtlessness from incompetency, and well-meant shortcoming from heedless or stupid blunder. As he should be universal and impartial in his rewards and approval of merit, so should he be judicial and unbending in his punishment or reproof of misconduct."

1. The latest form of Fitness Report for Officers quotes the above excerpts from the celebrated letter of John Paul Jones of September 14, 1775, describing the qualities which a naval officer should possess. These extracts are circulated by the Supply Officer for those of his commissioned subordinates who may not have seen this letter.

2. The traditions of the American Navy are exceptionally fine. That they are so has been largely due to the high ideals of conduct, which those officers who have been regarded by the service as typical, have constantly set themselves. The uniform of itself does not make an officer, but it does impose obligations on the man who wears it, which the cumulative traditions of almost a hundred and fifty years have made very real.

3. In no relation does an officer's quality appear so plainly as in his dealings with subordinates. Undue familiarity is as telltale as too great an assumption of superiority. The introduction of women in the navy has emphasized the requirements made upon all officers. In general during office hours they should be treated with the same courtesy and consideration which should distinguish his treatment of the men under him.

Favoritism in official relations, however, to women is as obnoxious as if extended to men.

4. As relations out of office hours have an almost compelling effect on those during hours of duty, these too should be considered in connection with those men and women who are official subordinates or are likely to become so.

More than 500 yeomen (F.) reported for duty during the months of May, June and July, 1918. These women were drawn from all parts of the naval district and apparently, owing to the fact that their enrollment was a new thing, were recruited without proper physical, mental or moral examination. The result was that a good deal of disagreeable weeding out had to be done. The writer soon found that he was not competent to solve the many feminine questions presented, so he established the local title of "Woman Counselor," and appointed three of the older and more settled women to receive and investigate reports raised in connection with the yeowomen, in addition to their other duties. He also secured the services, as a volunteer, of an exceptionally competent woman to act as woman supervisor, and arranged to have the women counselors confer either singly or in a body with her with regard to the more serious cases. This agency performed noteworthy service in running the gamut of feminine troubles from securing a yeowoman's trunk from a recalcitrant boarding-house keeper, to actually preventing a recaptured deserter from committing suicide in her fear and distress of mind. Through it the women in their new environment received more just and considerate treatment than either the Supply Officer or his principal subordinates had time or knowledge to give them. As a result there was no more contented or loyal part of the personnel than these women.

A year's experience with these women has convinced the writer that for certain work they were as good, if not better on the average, than men. In checking stores and in making retail issues, where their knowledge is sufficient, they are apt to be more careful in following the exact routine required than men of the same class. Some exceptional women were found qualified to put in charge of trucks and making deliveries. Some rose to be department managers. Several developed ability as time clerks, investigators in unraveling tangles or in tracing lost papers. They were more amenable than men to discipline, but more particular as to their personal convenience and more restive under navy

uncertainty as to their future. Morally, on the whole, their behavior under new and trying circumstances was excellent.

When the storm of war struck the Norfolk Supply Department it found it as well secured from the blast as the preparations permitted it would allow. The good ship heeled to the fury of the gale, which blew away some of its fancy rigging and even a necessary spar or two, but she did not capsize; and as time went on she righted and squared away with the wind. But this was only accomplished by each member of the crew doing what he was assigned several times as fast as ever before, and with a will and an individual sense of responsibility the evoking of which in America's citizens was one of this war's greatest manifestations.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

WHEN I WAS ON THE OLD U. S. S. *BIFTICK*

By LIEUT. COMMANDER K. C. MCINTOSH, S. C., U. S. Navy

Most of us spent our first week on the other side believing the stories we heard. We spent our second week doubting the stories we heard. Thereafter, even a captain's order had to be sworn to before a notary before we were quite certain it was real. This yarn reached me in my third month, after the soup and lobster and strawberries had been disposed of, and two or three former shipmates and I were eating that peculiar wiggly salad which the hotels in Brest have always on the menu—you remember it, long curling strings of tender green stuff with plenty of oil. The tale concerned a gunboat which was supposed to be convoying a string of freighters through the Mediterranean, steaming at some seven knots at the head of a single column. One of Fritz's tin fish took advantage of the formation to torpedo the last ship in line, and the gunboat shook out her reserve two-and-a-half knots and made for the trouble-spot. As she came down the line, Fritz went up the other side and got the leading ship. As the gunboat countermarched, so did the sub, and again got the tailing ship. This game of round the mulberry bush is said to have kept up until Fritz had torpedoed three ships in the rear and two in the van. Then the gunboat saw his wake and fired at him, and he departed, possibly having no more torpedoes. As I say, this tale was told me in my third month "Over There." It will require the sworn testimony of two-thirds of that gunboat's company to induce me to believe it as told; but the point is, the ship in question was said to be one who was more-or-less my happy home through three uproarious years in the days when "gunboating revolutions" was the most popular out-door sport of the brass-bound young. Old navy fashion, we will call her the U. S. S. *Biftick*. Herein are

set forth some of the adventures at which the *Biftick* assisted or took a leading part in those imperial days. You may take them with or without a grain of salt, for they occurred nearly fifteen years ago, and have many of them become shrouded in the golden haze of romance. I am quite likely to embroider some of them, but I do not think I shall injure their value as a picture of those times.

We drew less than thirteen feet, and so could get over the bar at the river-mouth. The "flagship" of the Spit-Kid Fleet could not, so we had the job of sitting on the lid at the revoluting capital. We were feeling proud of being the only naval ship who ever carried a president with a broken leg. We had picked him off the beach when his life was supposed to be in danger, and carried him to a haven of safety, before returning to see what his successor intended to do. Incidentally, on boarding us, his first anxiety was to whom he should surrender his gun. His next was "May I have something to eat? I have been at the American Legation for three days!" But that had happened some time ago, and much had been accomplished since. In order to find something to do, our pioneers had knocked down a large section of cliff to fill up a swamp near the coconut tree which served us as anchor. Then we had cleared a baseball field on the top of the cliff, and rolled a tennis court, which was as "sporty" as any golf course. We had tucked a target-range under a fold of the bluff, and put up a bathing pavilion on the beach. We had made a wharf for the steam launch to lie to at night, and an old freight car, polished up and labeled "Hotel de Bum" in large white letters provided sleeping-quarters for her crew. The landing abreast the ship displayed a sign "Little Coney Island" in black and yellow, and the place had grown to such proportions that a gentleman of a ripe yellow color named Pierre had opened an emporium between the target range and the Hotel de Bum, where for small silver one could obtain much ice and a little lemon or tamarind juice. Sometimes he even had tortillas. We were constructing what was to be our magnum opus—a shoot-the-shutes, made of an old narrow-gauge railway down the hill from the sugar factory to the river—when we were unpleasantly reminded that we were junior ship of the eleven around the island. The cable from the flagship's port was broken. The flagship had remained stationary until she was loath to move, and even the sailing directions were said to

read "Get Fraile Rock in line with the flagship's mainmast, then stand in to the harbor." The S. O. P. wanted a messenger to take his cablegrams to the next port, and we were the goat. We turned over Little Coney Island and its joys to a ship that did not appreciate it, got under way, and thus became the unconscious instrument of Providence, for the cables that we carried during the month contained the seed which eventually grew into the Clean Shirt Revolution.

We got our first surprise when attempting to carry out the above-mentioned sailing directions, for while it was in the right place, the mainmast seemed to have shrunk a great deal. When we got in, we found that the old flagship had gone, and the blue S. O. P. pennant flying from the tender. We found that another revolution in a neighboring island had called for marines, and the flagship having three hundred of them, had gone to set them ashore. The S. O. P. had packed a suitcase and his pennant and shifted his berth temporarily. By the end of a week, the suitcase became inadequate, and among the first 50 or 60 cables we carried, was one requesting the flagship's return. At the end of another week, we sent one requesting that she come back long enough to let the S. O. P. remove the balance of his worldly goods from the cabin. Still she did not return, and the next week we burned the cable with the news that "Revolution is imminent in Puerto Fulano—please return the *Dixie,* with or without marines." It was quite true—revolution is always imminent in Puerto Fulano—they hatch three plots before breakfast each day; but some reporter in Washington got hold of the three cables and applied the Sherlock Holmes method of deduction. The New York papers flared next day with scarehead columns of the revolution whose purpose was to provide a clean shirt for the Admiral. A gust of hilarity started which laughed eight out of eleven ships home to the states for overhaul before it subsided and they found out that there really was a revolution in Puerto Fulano after all. The *Biftick* was one of those who went home, but not for long. In a few months we were back on the job, the same old job. We really felt a homelike thrill when we wormed in through the narrow break in the reef and located our own old bonepile with the lead.

We grew to that job thoroughly. From end to end of the island, nearly every one of us was known by a nickname applied by the insurgent population, who fought us by day and swapped

yarns with us in the cafes by night. It was very friendly warfare, and we were very much annoyed when we got orders to leave our homely island and the ills we knew for the coast of Central America where we would have to keep in hand a totally strange set of politicos. We expressed our disapproval by all shaving our heads and turning our whiskers out to grow, so that we could at once strike terror to our new opponents and charges. We guessed wrong—we were on our way to the supreme experience of our entire cruise; the revolution in which the gunboats reached the pinnacle of power, authority and bliss. We were too late for the best of it, but there was plenty of joy for all hands.

The revolution in question was complicated by a foreign war, and the gunboat we relieved had heard that an invading army was approaching the port from the hostile power. The commanding officer sent for the local commandant and inquired what would happen when the enemy transport arrived. The commandant saw nothing for him but surrender—his forces and munitions were inadequate to a defence against such overwhelming odds. "Very well," said the commanding officer, "wait till you hear from me." Out to sea rolled the gunboat, to meet the invading navy. He summoned the commander-in-chief and inquired what were his intentions. "Take the town," was the answer; and again the commanding officer directed: "Very well, wait till you hear from me." Back went the gunboat while the invaders rolled outside, hove-to on the bosom of the Caribbean. "They're here," the commanding officer told the commandant. "If you are going, go ahead. I will have no fighting in the streets, and no damage to property. Beat it. They will not land till I give the word." In due time, the local army had fallen back up the railroad, and the invading conquerers landed to find an ensign, seven blue jackets and a Colt gun on the beach to see that there was no looting.

There was something over a hundred men in the invading army, but the ensign was over six feet high and very broad. They decided there would not be any looting just yet, and all hands, even to the "Cross Red Nurses," returned aboard the transport. Next day they ambled out and down the coast without warning. Post haste, out went the gunboat after them. The commanding officer was going to have no looting in the next town, either. Around a point, the hostile navy lay snugly hidden waiting to see

how her ruse would work, and was soon rewarded by the sight of the gunboat's yellow funnel rolling 30 degrees on her way down the coast. Under cover of night, the invaders slipped back, and began to spill overboard onto the Fruit Company's wharf and fall in before charging on the now unprotected town. The commander-in-chief felt proud of himself. He had tricked the Yankees, and he expected that in the next four hours his men would accumulate sufficient spoil to let them forget an overdue payday. Then a huge, moving shape appeared through the dusk, and into the lantern-light stepped the smiling ensign, mildly interested in the debarkation. A startled look up the wharf, and the commander-in-chief made out seven more white shapes, with a small dark something in their midst which might be a machine gun. His cry rent the night. *"Carajo, aqui estan los Americanos todavia! Á bordo, todos!"* When the deluded gunboat returned next day, the town was not looted, the soldiers were all aboard and anchored well off the beach, and the ensign was entertaining the commander-in-chief at lunch.

That commander-in-chief was an unusual man. His position was difficult, in that his army had consented to leave their country only on promise of four free hours in each captured city; and he owed his position to the fact that his president did not trust him and considered it safer to send him abroad. He succeeded in satisfying his soldiers and the American commander as well, and strangest of all, could see the funny side of the whole performance. Only once was he in trouble with the Yankee authorities, and the version I give is the one he himself told me two years after between courses at a banquet.

The American commander decided that peace would be more stable if coupled with sobriety. He therefore closed all saloons in the town after the invaders finally landed; and ordered the ensign-chief-of-police to arrest and send out to the ship everyone found under the influence of intoxicants. One day the general got very, very drunk, so drunk that he had fallen once or twice and had become exceedingly muddy. Commander-in-chief though he was, the ensign obeyed his orders, and soon a soiled and hilarious general was wabbling around the gunboat's quarterdeck. "Put him in the brig to sober up," directed the commander. Up spoke Jimmy Legs, "Captain, we just got the brig painted and look at the guy! He'll ruin my paintwork!" "Well, scrub him,

scrub him!" was the captain's answer, and so it came about that the victorious commander-in-chief, the famous general, sanded and canvassed to a tingling cleanliness, was soon sobering up in a very small and stuffy ship's brig. And later told the story on himself with many guffaws.

Meanwhile, the invaders had peaceably landed and thought themselves in possession not only of the port, but the towns up the railroad. "Thought themselves" is an exact statement, for in each town, living in the municipal mansion, giving dances with the municipal band, and administering justice with the aid of the foreign residents, could be found an ensign on "hazardous independent duty," having the time of his life. Down in the port, the gunboat's steam launch ran into the dock each morning and the bugles of the invaders trilled and snorted turning out the guard. White-gloved and immaculate, the Yankee captain walked the length of the one street, critically inspecting the sanitation and snappily returning the salute when the blue-jeaned lines of soldiers wavered into "present, arms!" The gentlemen who had been sent by the conquering foreign power to take over the civil government of the occupied district raged impotent. There was nothing for him to govern. His military backing was comfortably idle and happily powerless in the residence of those large and smiling ensigns. He received no sympathy from the white-gloved American, who informed him that as no stable government of a local nature existed, he, the American, was the Government. The gentleman might frame his credentials if he wished, and preserve them for his grandchildren. There was, however, nothing for him to be busy over in the war-stricken district, and his interference in its peaceable administration was not desired.

As a war, I think we will always look back upon that one as the best training in fishing and tennis that we ever received. There were spurts of activity, as when a malefactor was reported to our captain as having swindled a foreigner out of much money. The established method of procedure at that time was to bring him before a court composed of the captain and a consul or two, but he refused to be brought. For six days, we had a joyous chase. He was known to be on mule-back, making knots down the coast. He could not leave the coast, as to strike inland would be impossible even for a mule. So we chased him with the ship, hiding behind islands, bursting suddenly into towns in fanwise formation

to cover all approaches. He evaded us for a long time, warned by our smoke and doubling on his tracks. Finally we got him, and justice was done.

Then there was a period of leanness, while the Department spruced up the fleet for the Jamestown Fair and sent it forth on the voyage around the world. Gunboats were distinctly "out of luck" in those days, for requisitions for anything less than a hundred thousand cases of anything were of small moment "Up Home." We cleaned the beach of chickens, then of beef. We worked our seine night and day, and combed the hinterland for sweet potatoes. Finally, other methods having failed, the captain sent a classic cable: *"No stores, no coal, no money,"* it read. *"Shall I sell the ship?"* The effect was electrical. We were hurried to Key West, after getting a wagonload or two of slate tar and sulphur euphemistically called coal in one of the banana ports, and found everything we had ever asked for awaiting us. Just to make sure we got enough, we went to Guantanamo immediately after and found some more.

We became expert in dispensing justice to mixed peoples. The governor of a province (this was after peace was restored), who during hostilities had become our boon companion, entertained us with a dance and "supper." The dance stopped short at 12 o'clock, and we marched upstairs to where the "supper" was spread. There were no knives, forks, spoons or plates on the table, and the governor's band was lined up in one corner of the room. We solemnly took our places around the table and counted up the several sorts of glasses in sight, making hasty mental calculations to insure a dignified end to the party. The governor, glass in hand, welcomed us in a few well-chosen words. We all politely said *"Salud,"* and sipped our glasses. The band broke out into a spirited Central American version of the "Admiral's March." Our best linguist returned thanks in fragmentary Creole Spanish, celebrating the sisterhood of all republics. Every one said *"Salud!"* with a bit more spirit, and the band performed again. During the speeches, the band would go below and get a drink, returning in ample time to furnish harmonious applause. After three of four toasts, we found *"Salud"* pale and colorless and it was changed to *"Viva!"* The band began to add impromptu variations to the Admiral's March. At about 2 a. m., while an ensign heretofore guiltless of Spanish was making

a beautiful speech in pure Castilian there was an uproar on the stairs, and the large barkeep hoisted a blinking and bewildered bandsman into our midst. "Governor," he shouted in accents betraying his nativity, "dis guy pulled a knife on another of dem musicians! I want youse to know dis is a respectable joint, and dere ain't goin' to be no cutting in my place!" The governor stiffened and looked at the bandsman, who changed to a pale green color and gulped. The governor slowly reached back to his hip pocket and then remembered his guests and paused. "Gentlemen," he said with exquisite courtesy, "This rat has disturbed our festivities and has attempted to use a lethal weapon in your honored presence. I leave his fate in your hands. If you want him shot, I will do it myself." When we got our breath, we recognized the culprit as the clarinet player who had contributed most of the variations. He was strictly sober now, and about as scared as a man can be. Then up spoke an ensign from Texas. "His drawing a knife isn't near as much disturbance as he's been creating with that tootle of his. Suppose you punish him by anchoring him and his flute and a jug of water out in the bay to-morrow, and let him play and practice till he can do better." Followed a rapid stream of snappy orders from the governor, and two soldiers removed the almost fainting offender. Next morning when we caught the market boat out to the ship, we heard weird and melancholy sounds. A mile from shore rocked a small dinghy at anchor. Alone with his pipe and a jug of water sat our musician, and the wailful strains of "My Navajo" brought tears to the eyes of the surrounding fishermen.

Depleted by fatigue, desertion and the necessity of finding something beside sugar-cane to eat, the native garrison of a port we were inhabiting needed reinforcement. One day a train pulled in loaded down with a bedraggled lot of soldiers, whose blank, copper faces, stringy hair and uneasy movements marked them as Indians of the wildest from the interior. Their uniforms consisted only of dungaree coat and trousers, but it was plain that to the Indians they were as galling chains. With them came a message from an up-country governor: "I send you herewith a hundred volunteers. Please return the ropes." For two or three days these innocents padded hopelessly around their barracks in the basement of the Fruit Company's offices. Then one night, through the velvety blackness of a moonless, tropic evening,

there came many stabbing red flames and a crackle of Mauser shots. From the bay we could hear much shouting. Lights winked here and there, and the sound of slamming and barring doors arose from end to end of town. We looked at each other in amazement, for we thought we had every possible insurrecto well tabulated and safely distant. We sent an ensign and an ordinary seaman by way of landing party to investigate, and as they walked up the railroad, the seething population scattered before them "like cockroaches in a dark kitchen," to use the ensign's homely phrase. The local commandant, weeping, surrendered his sword and pistol to the ordinary seaman. There was tumult and tears and wailing of women. In an hour the landing force came back. "The Indians want to go home," he said, "and the governor wants 'em to go home. So I told him to send 'em home, and he will and everybody is happy." Next morning the volunteers, gloriously drunk and happy, loaded themselves into an up-country train and departed shouting "*Viva la Patria y mi madra!*" and on counting up the wreck of battle, we found ourselves to be the only sufferers. Stray bullets had smashed two crates of eggs which were to have been our breakfast, as they sat on the wharf. Naturally, this was christened the "Scrambled Egg Revolution."

But I think of all the days of joyous excitement, one Fourth of July will be the last to fade from our minds. We planned an all day celebration with a sister gunboat. Boat-races at seven in the morning, boxing and wrestling till noon, a big feed, field sports and swimming during the afternoon, and after dinner the best minstrels that the Caribbean had ever seen. The news flew up and down the coast, into the interior and over the mountains. Days before, isolated Americans, trying to remember what ice tasted like, climbed upon muleback to ride eighty or a hundred miles to the railhead. They came in crowds and swarms. They came in white linen, in blue jeans, in ancient frock coats and one even broke out a plug hat. By 6 a. m. the boats from shore were arriving, and all through the day the two ships were jammed stem to stern with ex-patriates some of whom had not heard a word of English in years. One man asked me seriously who was President of the United States, and in the next breath, "Is Shoemaker's Bar still on Pennsylvania Avenue?" They came and went, and every boatman in the harbor made his fortune that day. The minstrel show was on board the *Biftick*, and she was

well down by the stern when the guests were all assembled. It was far into the morning of the fifth before the last wistful reveller departed, and we looked at each other, wearily. The surgeon broke the silence. "If we had got under way tonight and gone to Mobile or New Orleans, I'll bet the Pinkertons wouldn't even have stopped to count up. They'd have landed us a million dollars in rewards without a question."

Like all junior, tropic exiles, we had our full quota of troubadours and bards—perhaps more. Our songs were in a plaintive minor as regards wording, but the tunes were youthful and exuberant enough. Grave-faced commanding officers, former plank-owners in the *Biftick*, how long could you preserve your dignity if you heard the old guitar tune up and someone launch into the interminable "Hymn to Santo Domingo," to the melody of "Mr. Dooley?" Every village of the island had its celebrating stanza, every politico on the beach; not even the American Minister, who suffered from gout, escaped our poetic frenzy. We composed roaring choruses to our alleged miserable exile; "alleged" I say, because in our innermost hearts we were having a wonderful time. Neither did we spare ourselves and each other. The thought of the popular ditty ending: "Oh, Oh, the Horse Marines, Johnny and the Purser!" still impels me to look for a cushion to put in my chair; and at least one officer will not soon forget that "the First Luff thought he must be dead, 'cause he didn't get back that night!" The crew caught the infection, and not a single catchy tune reached the ship that was not made into a *Biftick* pibroch inside of 48 hours, to the enormous benefit of our periodical minstrels. "Nettie's" cruel and unusual whiskers, "Jack's" alligator hunt, "John Calvin's" Spanish—all were set forth in deathless rhyme. And I have undying memory of a wailful ballad claiming that there was "No hardtack and slum in the old cabin home!"

How many "Mountain Goats" survive at the present day? That hill, the first sight most of us get of the "Black Man's Paradise" was named after a fancied resemblance of its outline to a human profile. After mature deliberation of the vast quantity of evidence adduced, we concluded that either some revolution had blown the features of the hilltop askew or else there was no General Order 99 in force on the *Santa Maria* when she named it; for the mountain now resembles nothing so much as a canvas

hangar in a number six breeze. However, it had its uses; and one remained a tenderfoot and a "coburger" until he had qualified as a mountain goat, a true, blooded, revolution-chaser, by climbing the mountain's hot red sides and proving to himself that from that viewpoint the salt pans inshore were indubitably dry and the sea offshore indubitably wet. After qualification, the badge of the order was a facial expression denoting extreme pessimism and a tremendous amount of vocal anarchy.

There was one thing upon which the *Biftick* prided herself above all others, and that was her superiority in sailing boats. It was as necessary a part of the day as breakfast to call all boats away, explain the course and rules of the day's race to the coxswains, ensigns, coal-passers, cooks, or whoever happened to be handling the boats that day, and start them out, wind or no wind. The invariable ensuing argument furnished excitement for the rest of the day, and notably the famous races where the coxswain of the gig, oars being barred, put his ship about by throwing out a bucket with a lanyard and hauling his stern around thereby; and that other when an ensign in a dead flat calm, *rocked* the second cutter home with belayed, slacked sheets and all hands on the gunwales. The result was apparent, and every ordinary seaman who left us for the Fleet found himself a coxswain overnight—probably coxswain of the gig. At Admiral's Inspection, the S. O. P. discovered that we allowed nothing to delay us in the matter of getting boats away—he was too close to the first cutter's davits when "Away all boats" was sounded, and the rush of her crew tumbled him head over heels. Every trick of every boat we had was known to a nicety, learned by bitter experience. My apprenticeship was served in the 28-foot cutter we vain-gloriously called the "sailing launch," and I had got to fancy myself as a seaman by the time I was given the gig. My pet trick was a 90-degree come-alongside at full speed, and I was anxious to try it with my newer, faster craft. The Little Gods decreed that the captain himself witnessed my first attempt, as at terrific speed I neared the ship, put my helm down at what seemed to be the proper moment—and stove in the gig's bow against the ship's side far abaft the gangway. In fear and trembling I came aboard; but the skipper's only comment was "She seems to maneuver wildly at great speed!" However, I never tried that again until I had

spent many hours coming alongside a wharf out of sight of the ship.

Let it not be thought, though, that the *Biftick's* cruise was all "beer and skittles." We point with pride to the first battle-practice the navy ever had. Fire-control apparatus there was none, so we made gadgets. A crude range-clock, christened by its inventor the "Boom-boom catcher," was installed and operated by the doctor in defiance of the Geneva convention. A canvas strip on two reels with 25-yard range changes decorated the wing of the bridge with a pay-office yeoman to turn the crank, and above it a wooden clock-face with large white hand for wind deflection. These were in plain sight of the sight-setters on the poop and forecastle, and a hose led from the sight-setter on No 1 gun's mouth to the ear of the sight-setter on the gun-deck. Our "brother-ship"—somehow those two ships were never called "She"—had a different lot of inventions. "Brother" shot first, and thought he had done very well; but the *Biftick*—! Let the cold figures tell the tale. When the Red Book came out we saw with bursting pride, *Biftick*, 60 per cent; highest battleship, 38 per cent; highest cruiser, 37 per cent"; and sweetest of all, "Next gunboat, 15 per cent. Such an event could not be allowed to die in the musty files of the executive-navigator-equipment-gunnery officer's office, and soon we were all singing, with abandon, that

"Paddy, he made just nine hits, not a single one more,
Which was considered by his crew as a pretty good score.
But when we steamed across the range you could hear our 4-inch roar.
We made two times nine hits, you see,—*and a little bit more!*"

In looking back it seems that must have been our motto in those days—"And a little bit more!" Work or play, rain or shine, dripping, mosquito-ridden Barahona or sun-baked Guantanamo or rolling the hammock-nettings under in the swell off Bluefields, every job that came our way was made into a game, was done, complete "and a little bit more!"

I see now that the old ship is listed for sale—paid off, her high hey-days a thing of the past. And I'll wager she dreams at times that the old days are back again and wakes listening for details of the latest outrage planned by her almost juvenile crowd of "plank-owners." May she rest in peace!

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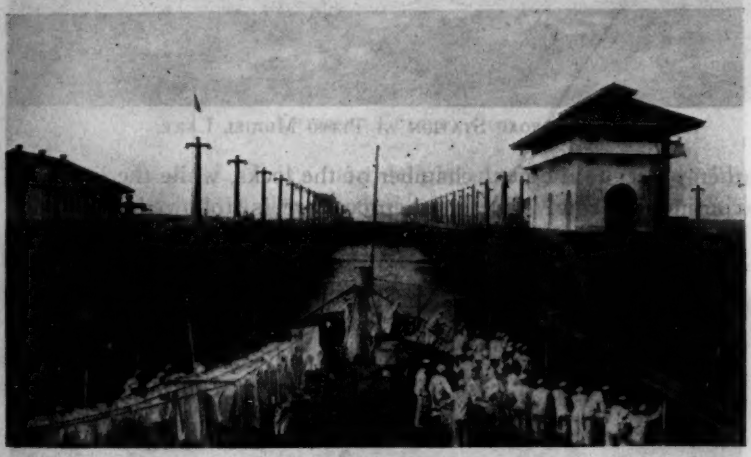
A TRIP THROUGH THE PANAMA CANAL

By R. J. FELD,[1] Seaman, U. S. Navy

To make a trip through the Panama Canal, takes approximately from eight to ten hours. We will start on our trip at 6 a. m. and terminate it about 2 p. m.



ENTERING THE UPPER CHAMBER GATUN LOCKS.

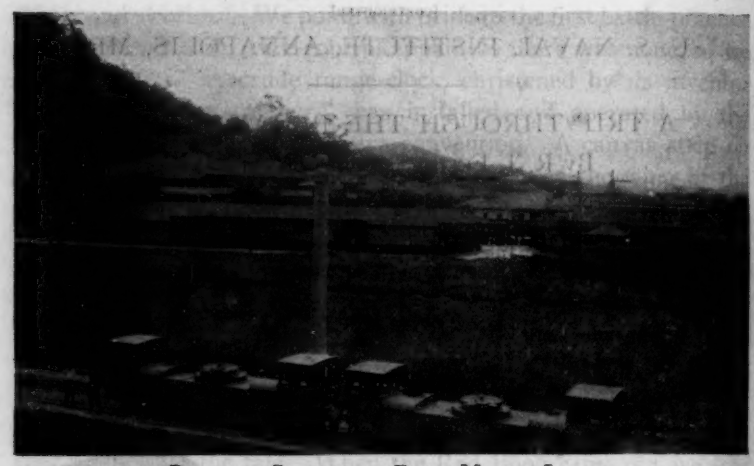
From the Atlantic side, we enter through the harbor of Colon. Tropical trees and foliage greet us on the shore, and houses with straw thatched roofs.

We start up the Canal with the birds and the balmy air of early morning greeting us. We approach the first series of locks, Gatun. Our ship is met by small trolley cars which throw cables to the ship, and tow it through the locks.

The locks are wonderful specimens of engineering accomplishment. The sides are cement and each has two large iron doors.

[1] Photographs taken by Edward J. Wheatley, Y., 3 c., U. S. N., U. S. S. *North Carolina.*

When our ship enters the locks, the large iron doors close and water is let in, thus raising the ship to a certain level. The ship



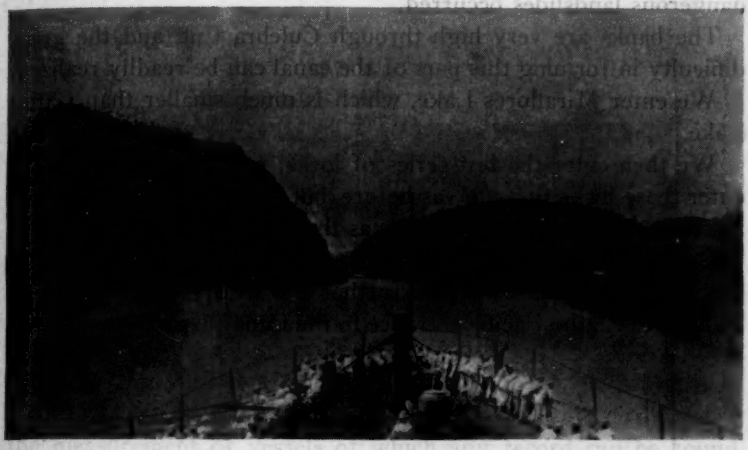
Railroad Station at Pedro Miguel Lake.

then passes to the next chamber of the locks, while the little cars continue to tow. The same procedure is followed again, and thence to a third chamber. From this we enter Gatun Lake.

At Bas Obispo, Showing the Famous Culebra Cut in the Distance.

A wonderful scenic and placid lake is this body of water. It is 25 miles in length and not very wide. Beautiful tropical scenery

abounds. Different specimens of water birds are to be seen. There are also highlands in the distance, and foliage and palm



Entering Culebra Cut.

trees are plentiful. It is a most delightful trip for the traveler and there is much that is pleasing to the eye. Leaving Gatun Lake we enter another series of locks, Pedro Miguel.

Passing Through Miraflores Lake, Showing Miraflores Locks Ahead.

The Pedro Miguel locks are the same as the Gatun locks. On passing out of these locks we enter the stream again, which is now

about the width of a river. We then pass through the famous Culebra Cut, where, during the construction of the Canal, many dangerous landslides occurred.

The banks are very high through Culebra Cut, and the great difficulty in forming this part of the canal can be readily realized.

We enter Miraflores Lake, which is much smaller than Gatun Lake.

We then enter the last series of locks, Miraflores Locks. We enter these locks the same as before, but the ship instead of being raised in the chambers, descends as the water is gradually let out. We descend through three chambers to tide-water level on the Pacific side. A short distance further and we are in the harbor of Balboa, C. Z., the Pacific entrance to the Canal.

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RULES FOR THE CALCULATION OF TONNAGE AND THEIR HISTORY

By LIEUT. COMMANDER CARL H. HERMANCE, U. S. N. R. F.

The term tonnage appears to have originated from the tun, cask of wine, the earliest system of measuring vessels being simply to count the number of casks or tuns of wine which could be carried and thus obtaining a measure of the internal capacity.

In the reign of Henry V, A. D. 1422, the first act dealing with the measurement of vessels of which any record can be found, required "Keels that carry coals at New-castle to be measured and marked," but it is not known how the measurement and markings were at that time carried out. In the year 1679 an act of the British Parliament extended the above regulation to the Wear, and prescribed that the Bowle Tub of Newcastle, containing 22½ gallons Winchester measure, and "allowing 21 bowls of coal to be measured by such Bowle Tub by heap measure," in measuring these river craft should always be used.

The "keels" were marked by nails upon the bulkheads at each end of the cargo space, or by driving nails into the stem and stern-post to indicate the corresponding load draft.

In the year 1694 another act of the British Parliament was passed for the measurement of keels, and a weight was then fixed upon as a standard, instead of a measure. This act required "keels to be measured by putting into them dead-weights of iron or lead, allowing 53 hundredweights to every chaldron of coals, and a maximum load of 10 chaldrons or 26½ tons. The load-line was then marked on the stem, stern and each side amidships.

By an act passed in 1775, the foregoing regulations for the Tyne and Wear were extended to vessels loading coal at all other ports of Great Britain, but the ton of 20 hundredweight avoirdupois was then made the standard weight, instead of the chaldron weight. The foregoing remarks relate to river craft only.

The measurement of ships, as distinct from the rough estimates of tonnage which are found in early records, appears to date from the first part of the 17th century, and the earliest rule which can be found is that given in Admiral Sir William Monson's tracts, published after his death in 1642. It is termed "A rule to know the burden of a ship: length of keel, 120 feet; breadth in beam, 40 feet; depths in hold, 20 feet; $40 \times 20 \times 120 = 96{,}000$ and $96{,}000 \div 100 =$ the burden, 960 tons." From a book entitled "The Complete Shipwright," written by Bushnell in the 17th century, we learn that the shipwrights of London on the river Thames had a custom of calculating the tonnage of a vessel by the following rule: "They multiply the length of the keel into the breadth of the ship at the broadest place, taken from outside to outside, and the product of that by half the breadth. This second product of the multiplication they divide by 94, or sometimes 100, and according to that division they are paid for so many tuns."

Bushnell proposed to ascertain the true measure of a ship's ability to carry, by first marking the water-line when ready for sea without any cargo on board, afterwards marking the lead-line, and then measuring the cubic content of the body of the ship between these lines.

This appears to be the earliest recorded suggestions of a method of measuring displacement between the light- and load-lines, but the manner in which it was proposed to estimate this displacement was a crude one, and it is unnecessary to reproduce it here.

It will be observed that the rule quoted differed from Monson's by substituting half of the breadth for the depth of the hold. This was a change much for the worse, but probably the half breadth was taken because the depth could not be measured when the vessel was laden, and for the ships built about the time the assumed proportion of the breadth to depth was a fairly correct average.

The first tonnage rule embodied in the act of the Parliament of England was that given in the act of 1694, which levied certain duties upon seagoing and coasting vessels, and is as follows:

$$\text{Tonnage} = \frac{L \times B \times D}{94}$$

where

length L is length of the keel taken within board (so much as she treads the ground).

B is the breadth within board by the midship beam, plank to plank.

D is the depth of the hold from plank below keelson to the under part of the upper deck planks.

Two years later the tonnage dues on shipping were repealed, and in that year (1696) the first act providing for the registry of shipping appears to have been been passed.

In 1720 a rule for the measurement of vessels, which was ultimately known as builders' tonnage, was first legalized in an act intended to prevent smuggling, by prohibiting small vessels of "30 tons burden and under from carrying spirits." This rule differed from that given in the act of 1694, in that half the breadth was substituted for the depth, thus making the rule the same as that previously referred to as the practice adopted by the Thames shipbuilders.

In 1773 a general rule for the measurement of all merchant vessels was made by Act 13 George III, and this, with some slight modifications, continued in force till 1835, and had a most evil effect upon naval architecture. This rule is as follows:

$$\text{Tonnage B. O. M.} = \frac{(L - \frac{3}{5}B) \times B \times B}{94}$$

where

length L is taken on a straight line along the rabbet of the keel from the back of the main sternpost to a perpendicular line from the fore part of the main stem under the bowsprit.

B is the breadth from outside to outside plank in the broadest place in the ship, be it either above or below the main wales, exclusive of all manner of doubling planks that may be brought upon the sides of the ship.

The principal difference between this rule and that given in the Act of 1720 is the manner of taking the length, which the latter act defined as "so much as treads on the ground"; and as this was probably uncertain in practice, the new length for tonnage was obtained by deducting three-fifths the breadth from the length.

Thirteen years later the act of 1773 was supplemented by the law for measuring the length of a vessel when afloat. The length was to be taken on the load water-line from the back of the sternpost to the front of the main stem, and subtracting from it 3 inches

for every foot of the load draft of water for the rake abaft, and three-fifths of the ship's breadth for the rake forward, the remainder being the length of the keel for the tonnage.

The effects of the foregoing tonnage rule are generally known; the tendency of a rule which only took into account the length and the square of the breadth being naturally to produce deep, narrow ships, which were not only unhandy, box-shaped vessels, but positively dangerous from their liability to capsize.

The old law of 1694, which took the depth into account, also caused vessels to be built with very full lines, and long after the tonnage rule known as builders' old measurement had been suspended by the new measurement its evil effects remained, for the shipbuilders continued to use it to describe their ships, and to build the deep dangerous vessels to show a large carrying capacity compared with the builders' tonnage. In 1821 a committee was appointed by the governor to revise the tonnage laws, and this committee reported that they would have liked to propose the measurement of the portion of the ship included between the light- and load-lines, but that this method was "liable to insuperable objection on account of the impossibility of ascertaining the position of these lines in a satisfactory manner."

They proposed, however, a rule of internal measurement, in which the mean of five breadths and two depths was taken: these multiplied together and by the length and the product divided by 112 gave the tonnage.

No legislation was ever attempted upon the report of this committee.

In 1833 another committee was appointed by the Admiralty and the result of their investigations was the tonnage rule known as the "new measurement," embodied in Acts 5 and 6 William IV, 1835.

This rule aimed at obtaining the internal capacity of a vessel by the smallest number of measurements, and the use of such a divisor as would give an average result equal to that by the old rule.

The rule may be summarized as follows:

1st. For vessels measured with a clear hold.

(a) The length of the upper deck between after part of stem and fore part of stern-post was divided into six equal parts.

(b) The depths were measured at the foremost, middle and aftermost points of division from under side of upper deck to the ceiling at the timber strake.

(c) Each of these three depths was divided into five equal parts, and the inside breadth measured at one-fifth and four-fifths from the upper deck of the foremost and aftermost depths and at two-fifths and four-fifths of the midship depth.

(d) The length of the vessel was measured at half the midship depth from after part of stem to fore part of stern-post. Then twice the amidship depth added to the foremost and aftermost depths was termed the sum of the depths. The upper and lower breadth of the foremost division added to three times the upper breadth and the lower breadth at the midship division and the upper and twice the lower breadth at the after division gave the sum of the breadth.

The sum of the depths multiplied by the sum of the breadths and then by the length and the product divided by 3500 gave the register tonnage.

The tonnage of the poop or half-deck was found by dividing the product of the mean inside length, breadth and depth by 92.4

2d. For vessels measured while loaded.

$$\text{Tonnage} = \frac{L \times B \times D}{130}$$

where

L is length of upper deck from after part of stem to fore part of stern-post.

B is inside breadth on under side of upper deck at middle of length.

D is depth from under side of upper deck down the pump well to the skin.

The tonnage of a poopdeck or raised deck was found by the rule already given and added to the result found by the above formula.

In either of these rules the allowance for engine space in steamers was the product of the length between the two bulkheads, the depth of the side amidships and the inside breadth at two-fifths

the depth from the deck, divided by 92.4, and the quotient was deducted from the gross tonnage.

The "new measurement" rule remained in force till 1854, but gave rise to a great deal of dissatisfaction, and was never popular.

A third committeee was appointed in 1849, and they recommended that tonnage should depend upon the entire cubic content of a vessel measured externally and including poop, forecastle and other covered-in spaces. Transverse sections were to be measured, and a curve constructed in which the ordinates represented to scale the area of each section, and the cubic content was found by calculating the area of this curve. The result was to be divided by 35, and then multiplied by .27, a factor chosen to give a result equal to the average result of the old law. A bill was introduced into Parliament in 1850 to give effect to these recommendations, but met with so little favor that it was withdrawn.

Mr. Moorsom then proposed, in the latter part of 1850, a scheme for the calculation of tonnage based upon internal measurement, so as to obtain the correct internal capacity of vessels, a register ton being 100 cubic feet of internal measurement. The divisor 100 was fixed upon, both for its convenience and to give a result practically corresponding with that under the old law.

This scheme is embodied in the Merchant Shipping Act of 1854, which with some modifications in details is the existing law for tonnage measurement, and the rules laid down in the act of 1854 may be briefly stated as follows:

The tonnage deck is the upper deck in vessels with less than three decks, and the second deck from below in all other ships.

The length is measured in a straight line along the upper side of the tonnage deck from inside of inside plank (average thickness) at the side of stem to the inside of the midship stern timber or plankther, as the case may be (average thickness), deducting what is due to the rake of the stern timber in the thickness of the deck and in one-third of the round beam, and the length so obtained is divided into a number of equal parts according to the following table:

Length under	50	ft.						divide into	4	equal	parts.
Length above	50	ft.,	not	exceeding	120	ft.		" "	6	"	"
" "	120	ft.,	"	"	180	ft.		" "	8	"	"
" "	180	ft.,	"	"	225	ft.		" "	10	"	"
" "	225	ft.	"	"				" "	12	"	"

At these points in the vessel's length a transverse vertical section of the internal volume is then measured by the following method:

The depth at each point of division is measured from a point one-third the round of beam below the deck, or, in the case of a break, from a line stretched in continuation thereof to the upper side of the ceiling, and if the depth as taken at the midship division does not exceed 16 feet, each depth is divided into four equal parts, and the horizontal breadths measured at each of the points of division, and also at the upper and lower points of the depth, the breadth being taken to the inside of ceiling, allowing an average thickness. By the application of Simpson's first rule, the area of each transverse section is then found by multiplying the second and fourth breadth by 4, and the third by 2; these products added together to the first and fifth breadths, and the sum multiplied by one-third the common interval, give the area. If the midship depth exceeds 16 feet, each depth is divided into six equal parts, the second, fourth and sixth breadths are multiplied by 4, the third and fifth by 2 and these products added to the first and seventh breadths, and the same multiplied by one-third the common interval, give the area.

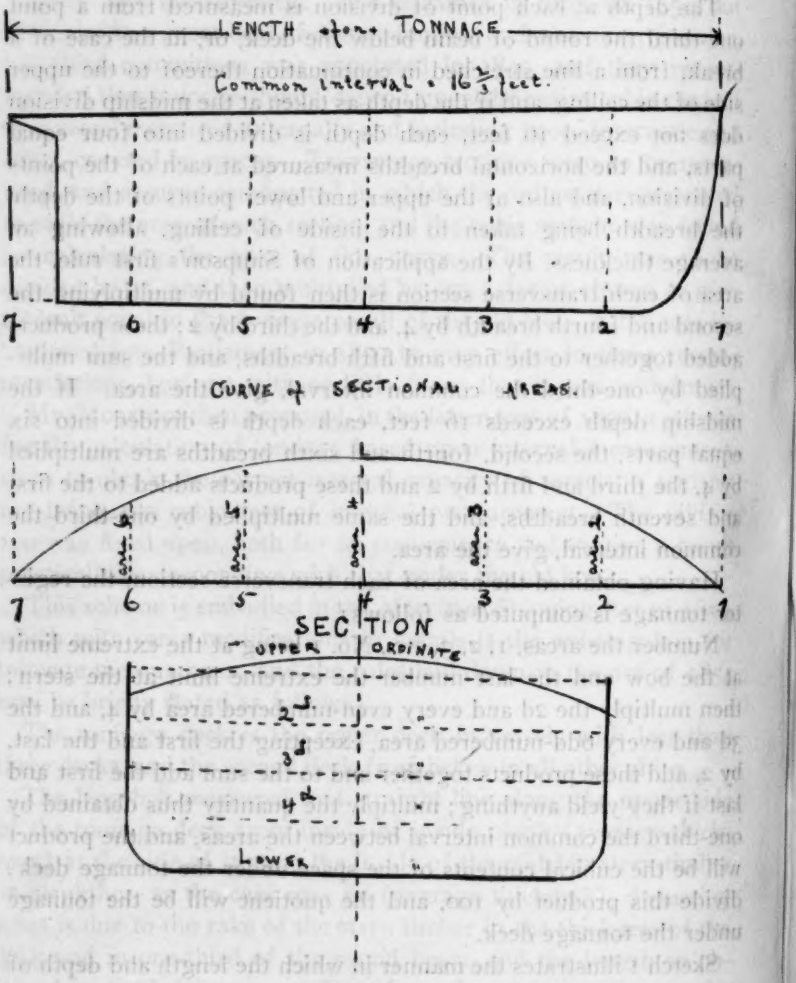
Having obtained the area of each transverse section, the register tonnage is computed as follows:

Number the areas, 1, 2, 3, etc., No. 1 being at the extreme limit at the bow and the last number the extreme limit at the stern; then multiply the 2d and every even-numbered area by 4, and the 3d and every odd-numbered area, excepting the first and the last, by 2, add these products together and to the sum add the first and last if they yield anything; multiply the quantity thus obtained by one-third the common interval between the areas, and the product will be the cubical contents of the space under the tonnage deck: divide this product by 100, and the quotient will be the tonnage under the tonnage deck.

Sketch 1 illustrates the manner in which the length and depth of the vessel are divided for measurement.

In vessels fitted with partial double bottoms for water ballast and also in cases where the inner bottom is not horizontal, but sloping upwards towards the side, additional subdivisions and measurements are made in order to calculate the internal capacity of the vessel.

Peak tanks, constructed for carrying water ballast only, and not available for cargo or stores, are, under certain conditions, allowed to be deducted from the gross tonnage.



SKETCH I.

Having ascertained the tonnage under the tonnage deck, there are various additions to be made to obtain the gross register tonnage, and deductions to be made from the gross to give the net register tonnage, upon which dues and charges are based.

The act provides that if there be a break or poop or any permanent enclosed-in space on the upper deck available for cargo or stores or for the berthing or accommodations of passengers or crew, the tonnage shall be ascertained thus: Measure the internal mean length of such spaces in feet and divide it into equal parts; measure at the middle of its height three inside breadths—namely, one at each end, and the other at the middle of the length, then to the sum of the end breadth add four times the middle breadth and multiply the sum by one-third the common interval between the breadths; the product will give the mean horizontal area of such space; multiply this product by the mean height, and divide by 100, and the quotient will be the tonnage which is to be added to the under deck tonnage, subject to the following provision, that nothing shall be added in respect of any building erected for the shelter of deck passengers, and approved by the Board of Trade.

If the ship has a third deck, the space between it and the tonnage deck is found by dividing the length into the same number of intervals as used in computing the tonnage under the tonnage deck, and having found the mean horizontal area of the space by the rule already given, this mean area multiplied by the mean height and divided by 100 gives the tonnage of the 'tween deck space, to be added to the tonnage already found for the portion below the tonnage deck; and if the vessel has more than three decks, the tonnage of each space between decks above the tonnage deck is similarly calculated.

Hatchways over cargo holds are also measured, and any excess above one-half per cent of the remaining gross tonnage is added to the gross tonnage.

The Merchant Shipping Act of 1854 also gives a rule for ascertaining approximately the tonnage of a vessel "measured for any purpose other than registry," and having cargo on board; also to ships measured for registry, but to which it is impossible to apply Rule I.

Rule II is as follows for wooden ships:

$$\text{Tons under deck} = \left(\frac{G+B}{2}\right)^2 \times L \times .0017,$$

where

L is length on upper deck from outside of outer plank on stem to perpendicular line from aft of rabbet in stern-post, just below where the counter plank crosses it.

B is extreme outside breadth of ship.

G is outside girth of ship from height of upper deck at one side to height of upper deck on opposite side.

The girth is taken by means of a chain passed under keel of the ship.

For an iron ship the same rule is used, but the final multiplier is .0018.

To the result found as above has to be added the tonnage of poops or other spaces above the upper deck, which is simply found by dividing the product of the mean length, breadth and depth by 100.

In the act of 1854 the multipliers for wooden and iron ships were, respectively, .0018 and .0021, but as these were found to give results largely in excess of Rule I, the factors were altered in 1858 to those given above.

The principal use of Rule II was to find the tonnage of foreign vessels for payment of dues previous to the adoption of the Moorsom system by other nations.

From the gross tonnage found, as already indicated, there are certain deductions to be made in order to obtain the net register tonnage.

The allowances on account of propelling space are briefly as follows:

Paddle vessels, in which the tonnage of the space solely occupied by and necessary for the boilers and machinery is above 20 per cent and under 30 per cent of the gross tonnage; in screw steamers, in which the tonnage of such space is above 13 per cent and under 20 per cent of the gross tonnage, a deduction of 32 per cent of the gross tonnage is allowed.

As regards all other ships that are under or over above percentages, the actual space occupied by boilers and machinery may be measured, and in paddle vessels the allowance is $1\frac{1}{2}$ times the actual space, and in screw steamers $1\frac{3}{4}$ times the actual space. In screw steamers the contents of the shaft trunk are deemed to form part of the engine and boiler space.

By the Merchant Shipping (Tonnage Act) Act 1907, the allowances for propelling space will in the future be limited for all vessels (except those used exclusively as tugs) to 55 per cent of the tonnage remaining after deducting from the gross tonnage any deductions allowed under Section 79 of the principal act, for

master's and crew's accommodations, navigation spaces, boatswain's stores, donkey engine and boiler, peak tanks, etc.

The rule for measuring of engine and boiler space provided for the inclusion of light and air spaces above the crown of the engine-room and the intention of the act was clearly to provide for such spaces, as indicated by Diagram 1. Spaces were, however, framed in above the upper deck, as shown, but by the act of 1854 could not be measured in the gross tonnage.

In 1879 the owners of the steamer *Isabella* contended that this upper space should be included in the engine-room space, and

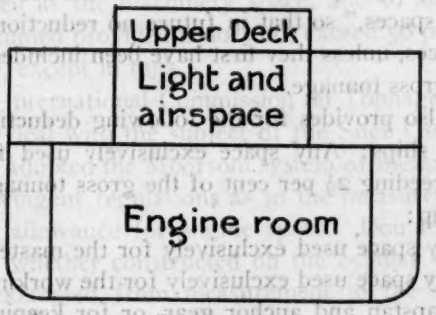


DIAGRAM 1.

their claim was allowed as being justified by the terms of the act. A reduction in tonnage was consequently obtained on this ground, but this was corrected in the act of 1889, which provides that in the future such spaces as those indicated must be included in the gross tonnage.

Besides the allowance for propelling power in steamers, all vessels may have a deduction made on account of crew space.

To obtain the allowances under this heading the crew space must be inspected and approved by a surveyor appointed by the Board of Trade, and provided not less than 72 cubic feet of space or 12 feet of deck area are set apart for each seaman or apprentice. An act passed in 1867 allows the actual cubic content of all spaces occupied by the crew except the master to be deducted from the gross tonnage.

In the act of 1854 all spaces above the upper deck for the sole accommodation of the crew were exempted from measurement; but the act of 1867 provided for the exemption of crew spaces

below the upper deck, and omitted to repeal the exemption under the act of 1854.

The effect of this was that if the crew were berthed above the deck the space occupied was exempted from measurement by the act of 1854, and then by the act of 1867 allowed to be deducted from the gross tonnage; or, in other words, allowed for twice. The owners of the steamer *Isabella*, already referred to, raised this point in 1879, and obtained judgment in their favor and since then a number of other vessels have obtained similar reductions in the net register tonnage.

The act of 1889 repealed the clauses of the act of 1854 dealing with "crew spaces," so that in future no reduction will be made for such spaces, unless they first have been included in the measurement of gross tonnage.

This act also provides for the following deductions:

1. Sailing ships: Any space exclusively used for storage of sails, not exceeding 2½ per cent of the gross tonnage of the ship.
2. Any ship:
   (a) Any space used exclusively for the master.
   (b) Any space used exclusively for the working of the helm, capstan and anchor gear, or for keeping charts, signals, and other instruments of navigation and boatswain's stores.
   (c) The space occupied by the donkey engine and boiler, if connected with the main pumps of the ship.
   (d) Any other space (other than double bottom) adapted only for water ballast.

These deductions are allowed provided the spaces referred to are certified by a board of trade surveyor as reasonable in extent and efficiently constructed, and they must be permanently marked so as to show the purpose for which they are intended.

By the Merchant Shipping Act of 1876, provision is made for the measurement of space occupied by deck cargo as follows: If any ship engaged in the oversea trade carries cargo in any space on the upper deck which has not been measured under the act of 1854, the tonnage of the space occupied by the cargo is to be measured and added to the taxable tonnage. This regulation gives a variation in the taxable tonnage from one voyage to another. The usual definition of home trade taken in this act,

is the coasts of the United Kingdom and those of the continent from the Elbe to Brest.

The Danube International Commission adopted in 1860 the Moorsom system of measurement, and subsequently accepted a method of allowance for propelling space as follows:

The actual machinery space was measured exclusively of bunkers, and $1\frac{1}{2}$ times that space allowed for paddle steamers and $1\frac{3}{4}$ times for screw steamers, subject to the total allowance not exceeding 50 per cent of the gross tonnage, except in tugs. This is usually termed the Danube rule.

Another rule, known as the German rule, is to measure the coal bunkers as well as the machinery space, and to allow the total space thus occupied provided it does not exceed 50 per cent of the gross tonnage, except in tugs.

In 1873 an International Commission on Tonnage met at Constantinople to deal with the subject of the Suez Canal dues, and although they adopted the Moorsom system of measurement, they made more stringent regulations as to the measurement of deck erections and allowance for engine space. Double bottoms for water ballast, whether constructed on the cellular or MacIntyre system, are exempted from measurement in the same manner allowed by the English law.

The Suez Canal rules for measurement of deck erections will not be discussed here as they can easily be learned from those rules.

The Danube Commission accepted, in 1876, the Suez Canal rules, so that the same certificate is now available for both.

Vessels using the Suez Canal are provided with a special certificate of tonnage (same as nowadays for Panama Canal).

In vessels with fixed coal bunkers, the German rule may be used for obtaining the allowance for propelling space, while vessels with shifting bunkers are measured by the Danube rules, and the maximum allowance for crew spaces, galley spaces, W. C.'s and navigation spaces is 5 per cent of the gross tonnage.

The Moorsom tonnage measurement has been adopted by most of the maritime nations of the world, although the allowances for engine space differ in some cases, and the crew space deductions for nearly all countries are limited to 5 per cent of the gross tonnage.

Freight Tonnage.—This is simply a measure of cubical capacity, a freight ton being 40 cubic feet of space. This tonnage has no legal authority, but is largely used by merchants and shipowners as a measure of the capacity of vessels.

REGISTER TONNAGE AND DISPLACEMENT

Register Tonnage is a measure of a vessel's internal capacity, a register ton being 100 cubic feet of internal space.

Displacement is a measure of the weight of a vessel and her outfit and cargo, a ton of displacement being 20 hundredweight avoirdupois.

The weight of a floating body is equal to the weight of fluid displaced, and in order, therefore, to ascertain the weight of a vessel and her contents at any given draft, it is only necessary to calculate the weight of the volume of fluid displaced.

As the register tonnage is that upon which a vessel has to pay dock and other dues, while the dead-weight carrying capacity represents the earning power of an ordinary cargo vessel, it is obvious that from a shipowner's point of view the most profitable vessel is the one which can carry the greatest amount of cargo in relation to her register tonnage.

The method of estimating the official tonnage known as the "Builder's old measurement rule" in which the square of the breadth entered into the calculations while the depth was neglected fostered the building of dangerously narrow and deep ships with very full forms, so as to produce a large carrying power with a comparatively small official tonnage.

The present tonnage laws aim at ascertaining accurately the internal capacity of the vessel, and there is not now the same inducement to build such badly proportioned ships.

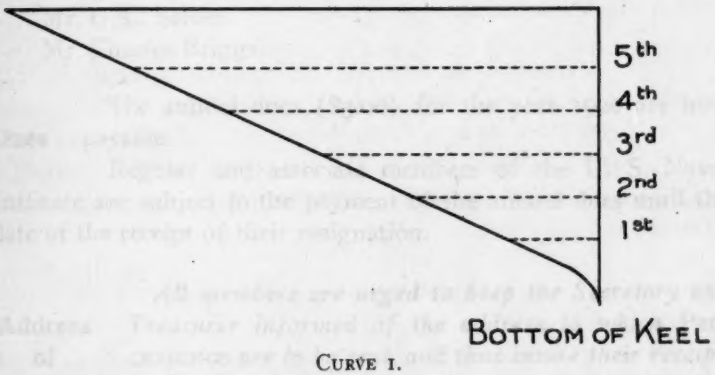
The displacement of a vessel is calculated from the drawings, and the method of calculation is similar in principle to that adopted for the measurement of the internal capacity; but the naval architect is not fettered by any definite number of subdivisions as laid down in the tonnage laws, and is free to determine the number of transverse sections and ordinates deemed necessary according to the size of the vessel.

The area of each section is calculated by means of Simpson's rules and the areas of these sections then treated as ordinates of

a curve of sectional areas, the result being the volume in cubic feet. To this volume must be added the volume of any appendages, such as keel, rudder, etc., so as to obtain the total volume displaced.

Thirty-five cubic feet of salt water weigh 1 ton; if therefore the volume in cubic feet be divided by 35, the result will be the displacement in tons.

It is usual in carrying out this calculation to arrange the ordinates of the various sections and water-lines on a sheet in such a manner that the areas of each may be readily ascertained and at the same time to calculate the center of buoyancy, or the



CURVE 1.

center of gravity of fluid displaced, and to construct curves of displacements and tons per inch immersion.

The curve of displacement is constructed by setting off the displacement as calculated at different drafts (mean), as ordinates of a curve on any convenient scale, so that the displacement at any intermediate mean draft may be ascertained without the labor of separate calculations, by simply measuring with the same scale the length of the ordinate at any given draft. The curve of displacement is usually as shown in the illustration (Curve 1), and is, of course, only to be used for obtaining the displacement at any mean draft of a vessel on a fairly even keel and the displacement at any exceptional trim would have to be calculated separately.

5th
4th
3rd
2nd
1st
BOTTOM OF KEEL

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Membership

Life, regular and associate membership, 5500. New members, 12. Resignations, 37. Dropped, 1. Deaths (3):

Ensign J. O. Plonk, U. S. Navy.
Mr. G. L. Selden.
Mr. Charles Briggs.

Dues

The annual dues ($3.00) for the year 1920 are now payable.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

Address of Members

All members are urged to keep the Secretary and Treasurer informed of the address to which PROCEEDINGS ***are to be sent, and thus insure their receipt.***

Members and subscribers are urged to notify the Secretary and Treasurer promptly of the non-receipt of PROCEEDINGS, in order that tracers may be started. The issue is completed by the 15th of each month.

Book Department

The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books, should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

Reprints of Articles

The attention of authors of articles is called to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article

is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations

Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice

Whole Nos. 6, 7, 10, 13, 14, 15, 17, 145, 146, 147, 149, 155 and 179 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., JANUARY 15, 1920.

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UNITED STATES NAVAL INSTITUTE
ANNAPOLIS, MD.

REPORT OF AUDIT FOR THE YEAR ENDED DECEMBER 31, 1919

BALTIMORE, MARYLAND, January 7, 1920.

TO THE OFFICERS AND MEMBERS OF THE UNITED STATES NAVAL INSTITUTE, ANNAPOLIS, MARYLAND.

Gentlemen.—We have audited the books of the *United States Naval Institute, Annapolis, Maryland,* for the year ended December 31, 1919, and submit herewith a certificate, one page of comments and the following exhibits and schedules:

Exhibit A.—Balance sheet as of December 31, 1919.

Schedule No. 1.—Statement of cash receipts and disbursements for the year ended December 31, 1919.
Schedule No. 2.—Investments.
Schedule No. 3.—Accounts receivable.
Schedule No. 4.—Accounts payable.
Schedule No. 5.—Advanced payments.
Schedule No. 6.—Surplus all as of December 31, 1919.
Schedule No. 7.—Statement of income and expense for the year ended December 31, 1919.

Exhibit B.—Comparative balance sheet December 31, 1918–December 31, 1919.

Respectfully,
BLACK AND COMPANY,
Certified Public Accountants,
By WILMER BLACK, C. P. A.
(*Member American Institute of Accountants.*)

UNITED STATES NAVAL INSTITUTE
ANNAPOLIS, MARYLAND

CERTIFICATE

We have audited the books of the *United States Naval Institute, Annapolis, Maryland,* for the year ended *December 31, 1919,* and

We hereby certify that the accompanying *balance sheet* and *statement* of *income* and *expenses* are correct; and, in our opinion, subject to the attached comments, clearly set forth the true financial condition as of *December 31, 1919,* and result of operations for the year ended *December 31, 1919,* respectively, as disclosed by the books of account.

BLACK AND COMPANY,
Certified Public Accountants,
By WILMER BLACK, C. P. A.
(*Member American Institute of Accountants.*)

Baltimore, Maryland, January 7, 1920.

UNITED STATES NAVAL INSTITUTE
ANNAPOLIS, MARYLAND

COMMENTS ON THE AUDIT FOR THE YEAR ENDED DECEMBER 31, 1919

An analysis of Exhibit B, *comparative balance sheet, December 31, 1918–December 31, 1919,* discloses the following interesting information:

Assets Increased.		
Cash		$8,627.48
Investments		32,255.62
Prepaid expenses		446.17
Furniture and fixtures		350.00
Liabilities Decreased.		
Accounts payable		37,647.49
		$79,326.76
Deduct: Assets decreased.		
Accounts receivable	$53,475.42	
Inventory	87.14	
Prepaid royalties	993.83	
Credits Increased.		
Advanced payments	86.75	
Reserved for bad debts	883.04	
Reserved for bad dues	567.45	
Reserve fund	310.00	
		56,403.63
		$22,923.13
Surplus.		
Balance, January 1, 1919	$149,044.46	
Add: Adjustments (for details see Exhibit A, Schedule No. 1)	1,278.85	
Net profits, December 31, 1919 (for details see Exhibit A, Schedule No. 6)	23,121.48	
	$173,444.79	
Deduct: Adjustments (for details see Exhibit A, Schedule No. 6)	1,477.20	
	$171,967.59	
Deduct: Balance, January 1, 1919	149,044.46	
		$22,923.13

Exhibit A, Schedule No. 1 shows the cost of publications sold, $102,483.79. The overhead this year is $15,231.72, as against $11,852.64, last year, and 14.87 per cent should be added to the cost this year instead of 5.97 per cent last year.

Our examination disclosed no discrepancies or inaccuracies the books being well and accurately kept. We found the records, papers, books, etc., in good condition.

EXHIBIT A

BALANCE SHEET, DECEMBER 31, 1919

ASSETS

Current Assets.		
Cash (in bank), Schedule No. 1	$52,644.81	
Investments, Schedule No. 2	98,060.62	
Accounts receivable, Schedule No. 3	20,781.60	
Inventory	15,072.82	
Prepaid royalties	200.00	
Total Current Assets		$186,759.85
Balance		$180,966.00
Furniture and fixtures		450.00
Prepaid expense		446.17
		$181,862.17

LIABILITIES

Current Liabilities.		
Accounts payable, Schedule No. 4		$3,828.08
Advanced payments, Schedule No. 5		1,965.77
Total Current Liabilities		$5,793.85
Balance (excess of current assets over current liabilities)		180,966.00
		$186,759.85
Reserve for *bad debts*		$883.04
Reserve for *bad dues*		567.45
Reserve fund.		
Balance, January 1, 1919	$8,134.09	
Cash Receipts	310.00	
		8,444.09
Surplus, Schedule No. 6		171,967.59
		$181,862.17

EXHIBIT A.—SCHEDULE No. 1

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED DECEMBER 31, 1919

Balance, January 1, 1919		$44,017.33
RECEIPTS		
Dues	$8,738.54	
Subscriptions	2,318.73	
Sale of books purchased	2,959.01	
Advertisements	2,650.72	
Interest on investments—bank balances	6,038.61	
Postage	19.75	
Binding	127.41	
Sale of extra publications	168,168.92	
Sale of Proceedings	1,156.63	
Credits	21.48	
Overpayments	1,129.21	
Life fees	196.25	
Prepaid dues	264.05	
Prepaid subscriptions	326.88	
Sundries	121.97	
Total receipts		$194,238.16
		$238,255.49
Balance, January 1, 1920		**$52,644.81**
DISBURSEMENTS		
Printing and binding Proceedings	$20,925.14	
Printing and binding extra publications	84,928.11	
Salaries	11,010.83	
Contributors	5,843.94	
Authors of books (royalties)	15,252.31	
Postage and telegrams	2,560.55	
Expressage, freight and hauling	1,351.88	
Board meetings	733.60	
Purchase of books for sale	2,595.56	
Office expense, stationery, supplies, etc.	1,800.89	
Advertising	762.89	
Supplies	433.05	
Lawyers fees	250.45	
First honorable mention award	125.00	
Second honorable mention award	100.00	
Overpayments	117.36	
Sundries	77.68	
Office furniture	1,001.74	
Insurance	198.42	
Purchase Victory Loan Bonds	34,395.62	
Interest	333.16	
Gratuity	212.50	
Total disbursements		$185,610.68
Balance, December 31, 1919		**52,644.81**
		$238,255.49

Balance, December 31, 1919.....			$52,644.81
Seamen's Bank for Savings, New York City.			
Balance as per letter dated January 8, 1920			$3,000.00
Rhode Island Hospital Trust Co., Providence, R. I.			
Balance, December 31, 1919			4,021.24
Annapolis Banking and Trust Co., Annapolis, Maryland.			
Balance as per letter dated January 9, 1920			8,434.06
Society for Savings, Hartford, Conn.			
Balance as per letter dated January 9, 1920			4,080.08
Farmers' National Bank, Annapolis, Maryland.			
Balance as per statement dated January 3, 1920		$36,402.71	
Less Outstanding Checks.			
#2747	$ 2.50		
3171	1.80		
3439	2.04		
3498	1.50		
3752	8.00		
3926	5.00		
4544	5.00		
5117	5.00		
5430	28.50		
5798	20.00		
5812	3.95		
5820	20.00		
5822	5.00		
5823	2.50		
5824	54.00		
5825	158.17		
5826	19.50		
5827	91.00		
5828	38.50		
5829	9.00		
5830	5.00		
5832	35.00		
5833	20.00		
5836	50.00		
5839	4.00		
5840	10.00		
5841	2,681.09		
5842	7.23		
		3,293.28	
		$33,109.43	$52,644.81

EXHIBIT A.—SCHEDULE No. 2

SECURITIES (BONDS) DECEMBER 31, 1919

	Par Value	Book Value
Southern Railway (87).		
6 $1000 5% registered gold bonds, #M257-247-475-476-477-478, due July 1, 1994	$6,000.00	$5,220.00
Washington Railway and Electric Company (58).		
2 $1000 4% 50 year gold consolidated mortgage bonds, #2183-2184, due July 1, 1951, coupon bonds	2,000.00	1,160.00
Northern Pacific and Great Northern R. R. (95).		
8 $1000 joint bonds registered 4%, due July 1, 1921, #M13253-4-5-11769-70-1-2-11171. 2 $5000 C. B. & Q. collateral registered 4%, due July 1, 1921, #5199-5401	18,000.00	17,100.00
Northern Pacific Ry. (56).		
4 $1000 3% registered gold bonds, #M1610-1-2-1650. 1 $5000 3% registered gold bond, #1123. 3 $1000 3% registered gold bonds, #M21543-4-5, general lien due January 1, 2047 coupon bonds	12,000.00	6,720.00
B. & O. R. R. Company (67).		
1 $5000 1st mortage 4% 50-year gold registered due February 17, 1960, #A436	5,000.00	3,350.00
1 $1000 1st mortage 4% 50-year gold, registered, due February 17, 1960, #M1230 (67)	1,000.00	670.00
3 $1000 prior lien 3½%, due 1925, #SM383-4-5 (82½)	3,000.00	2,475.00
($8,444.09 of these bonds belongs to the Reserve Fund.)		
Potomac Electric Power Company (94½).		
2 $1000 5%, #833-4, due June 1, 1929	2,000.00	1,890.00
New York City Registered 4½% (94).		
1 $7000, #588, due March 1, 1962, corporate stock	7,000.00	6,580.00
3½% Liberty Loan Bonds Registered.		
5 $1000, #6033-4-5-6-7, due June 15, 1947	5,000.00	5,000.00
4% Liberty Loan Bonds 2d 1917.		
3 $1000, #16830-1-2, due November 15, 1927	3,000.00	3,000.00
4¼% Liberty Loan Bonds.		
5 $1000, #26484-5-6-7-8, due September 15, 1928	5,000.00	5,000.00
4¼% Liberty Loan Bonds.		
1 $5000, #2029, due October 15, 1938	5,000.00	5,000.00
4¾% Victory Loan Bonds.		
25 $1000, #C152590-1-2-3-4-5-6-7-8-9-152600-1-2-3-4-5-6-7-8-9-10-11-12-13-14, due May 20, 1923. 2 $5000, #A1248-1249, due May 20, 1923	35,000.00	34,895.62
	$109,000.00	$98,060.62

EXHIBIT A.—SCHEDULE No. 3

ACCOUNTS RECEIVABLE, DECEMBER 31, 1919

Back dues	$9,237.56
Subscriptions	57.00
Advertisements	355.03
Extra publications	11,132.01
	$20,781.60

EXHIBIT A.—SCHEDULE No. 4

ACCOUNTS PAYABLE, DECEMBER 31, 1919

The Postmaster	$22.94
Longsmans, Green & Co.	16.77
Wycil and Company	11.36
American Railway Express Co.	30.51
E. P. Dutton & Co.	11.26
Franklin Printing Co.	93.25
The Rudder Publishing Co.	3.88
Rebman Co.	5.14
Little, Brown & Co.	7.82
James Gantt	7.12
The Macmillan Co.	2.06
Underwood & Underwood Inc.	3.80
Charles Scribner's Sons	1.65
The Century Co.	5.57
Pugsley's Nautical Press	1.65
The Survey	1.88
C. A. Friemel	1.50
George H. Doran Co.	4.15
Robt. M. McBride & Co.	2.42
Boni & Liveright, Inc.	.61
Underwood Typewriter Co.	2.25
Chesapeake and Potomac Co.	2.60
Western Union Telegraph Co.	1.49
Franklin Hudson Publishing Co.	1.51
Thomas Nelson & Sons	1.40
Naval Academy Officers' Mess	6.80
Cosmopolitan Book Corporation	1.86
John Wiley & Sons	3.19
Sundry authors, royalties	2,542.05
Sundry credits, overpayments	1,029.59
	$3,828.08

EXHIBIT A.—SCHEDULE No. 5

ADVANCED PAYMENTS, DECEMBER 31, 1919

Dues	$969.38
Subscriptions	996.39
	$1,965.77

EXHIBIT A.—SCHEDULE No. 6

SURPLUS, DECEMBER 31, 1919

Balance, January 1, 1919		$149,044.46
Add:		
Adjusting inventory to agree with the cost to print	$1,278.85	
Net profit for the year ended December 31, 1919, for details see Exhibit A, Schedule No. 7	23,121.48	
		24,400.33
		$173,444.79
Less:		
Reduction of selling price on French and Spanish Readers to midshipmen's store	$380.95	
Transfer to Reserve Fund	96.25	
Transfer to Reserve for Bad Debts	1,000.00	
		1,477.20
		$171,967.59

EXHIBIT A.—SCHEDULE No. 7

STATEMENT OF INCOME AND EXPENSES FOR THE YEAR ENDED DECEMBER 31, 1919

Inventory, January 1, 1919.			
Extra publications		$15,159.96	
Add: Purchases for year.			
Books for sale	$2,146.47		
Printing and binding Proceedings	17,972.88		
Printing and binding extra publication	55,119.56		
		75,238.91	
		$90,398.87	
Deduct: Inventory, December 31, 1919			
Extra publications		15,072.82	
			$75,326.05
Expressage, freight and hauling	$367.21		
Contributors	5,843.94		
Authors of books (royalties)	18,199.77		
First honorable mention award	125.00		
Second honorable mention award	100.00		
Postage and telegrams	2,521.82		
			27,157.74
Cost of publications sold			$102,483.79
Profit on sales of publications, etc			16,480.44
			$118,964.23
EXPENSES			
Auditing		$225.00	
Salaries		11,010.83	
Office expenses		409.18	
Board meetings		733.60	
Insurance		170.00	
Advertising		763.73	
Interest		333.16	
Office supplies		1,586.22	
Total expenses		$15,231.72	
14.87% on cost.			
13.11% on sales.			
Bad accounts charged off	$160.58		
Furniture charged off	120.84		
Bonds charged off	2,640.00		
		2,921.42	
Total deductions		$18,153.14	
			$18,153.14
Excess of income over deductions transferred to surplus			23,121.48
			$41,274.62
Sale of extra publications			$113,622.39
Sale of books			2,492.06
Total sale of publications			$116,114.45
Advertising			2,744.63
Binding			105.15
			$118,964.23

Profit on sale of publications, etc	$16,480.44
Dues and subscriptions	17,717.19
Interest on investments	6,014.11
Miscellaneous and premiums	1,062.88
	$41,274.62

EXHIBIT B

COMPARATIVE BALANCE SHEET FOR THE TWO YEARS ENDED DECEMBER 31, 1918 AND DECEMBER 31, 1919

ASSETS

	Dec. 31, 1918	Dec. 31, 1919	Increase	Decrease
Cash	$44,017.33	$52,644.81	$8,627.48	
Investments	65,805.00	98,060.62	32,255.62	
Accounts receivable	74,257.02	20,781.60		$53,475.42
Inventory	15,159.96	15,072.82		87.14
Prepaid royalties	1,193.83	200.00		993.83
Prepaid expenses		446.17	446.17	
Furniture and fixtures	100.00	450.00	350.00	
	$200,533.14	$187,656.02		

LIABILITIES

Accounts payable	$41,475.57	$3,828.08		$37,647.49
Advanced payments	1,879.02	1,965.77	$86.75	
Reserve for bad debts		883.04	883.04	
Reserve for bad dues		567.45	567.45	
Reserve fund	8,134.09	8,444.09	310.00	
Surplus	149,044.46	171,967.59	22,923.13	
	$200,533.14	$187,656.02		

This report of audit was accepted and approved by the Board of Control, for publication, February 10, 1920

S. A. TAFFINDER,
Secretary and Treasurer,
U. S. Naval Institute.

PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER WALLACE L. LIND, U. S. Navy

GENERAL ARRANGEMENT

VESSELS BUILDING.
NAVAL POLICY.
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FRANCE

FRANCE MOBILIZED 9,000,000 MEN.—In presenting the Loan bill to the French Chamber of Deputies on Dec. 29 Minister of Finance Louis Klotz stated that in the World War France mobilized 9,000,000 men, or eighty per cent of those of mobilizable age. England, he asserted, mobilized fifty-two per cent of the men who could be called to the colors and the United States six per cent. He declared, "We will be unanimous in putting a supertax on those who enriched themselves during the war, those who were enriched scandalously, profiting by the public disaster."—*Army and Navy Journal*, Jan. 24, 1920.

INTERNAL COMBUSTION FOR NAVY VESSELS.—In his work, "Les Enseignements Maritime de la Guerre Anti-Germanique," Contre-Amiral Daveluy, of the French Navy, who presents his conclusions as to various phases of the naval operations of the Entente powers in the World War, expresses the interesting belief that the fleet of to-morrow will be vastly different from that which fought the great conflict. He asserts that certain classes of ships are bound to disappear, while others will necessarily be compelled to undergo radical changes. He hopes that the French Navy will distinguish itself, among other particulars, along lines affecting the form of motive power and also the exterior aspect of fighting ships. He very strongly advocates that in all vessels of that navy internal combustion be substituted for steam. From the military point of view the disadvantages of steam, he says, are multitudinous. Only an officer who has made cruises in search of an enemy or who has otherwise operated on the high seas can fully realize the great distance at which smoke from another ship, using coal for fuel, can be discerned. The smoke from his own ship also interferes with the vision while endeavoring to see another ship in time of war and at the same time seeking to conceal his own presence. In order to overcome the first difficulty, the Admiral writes, and to accomplish the other object it is indispensable that ships be given a motive power by

means of which their presence may not be revealed to the enemy long before the hulls of the ships themselves may be discerned above the horizon, either from the deck of the observing vessel itself or from watchful aircraft. Another great advantage which ships whose motive power is internal combustion possess over those propelled by steam, he observes, is that the former require neither boilers nor condensers, which occupy much room and add to the dead weight; and also that the ships are not filled up with coal, also making for greater weight; and while of the same tonnage are consequently much less encumbered than are ships using steam power. This last consideration, he points out, is a very important one in view of the fact that under such conditions it is no longer necessary to place weight where the shock of the exploding enemy torpedo is susceptible of determining the explosion of ammunition on the vessel attacked. Another point in favor of liquid fuel, he claims, is the ease with which a ship may be refueled, a particularly great advantage over ships burning coal and making long cruises, and where the taking in of coal is often a difficult matter. For some years the question of internal combustion has been under consideration by naval authorities, he recalls, not alone for small craft but in the case of cruisers and other craft of greater tonnage. The objection has been made that France does not possess sources of oil supply, and while this is true, the noted naval critic admits, yet possessing coal mines it was able to contribute its share in naval operations during the war. Furthermore, he concludes, it is by no means certain that there are no oil fields in Algeria, a French possession.—*Army and Navy Journal*, Jan. 24, 1920.

ANGLO-FRENCH SQUABBLE OVER ENEMY TONNAGE.—Through the publication two weeks ago of a letter of the French Minister of Maritime Transport to Prime Minister Clemenceau, it has become known that England and France are in disagreement regarding the disposition to be made of the enemy merchant ships seized during the war or surrendered under the terms of the peace treaty. According to this communication, President Wilson and Premier Lloyd George entered into an agreement on May 9 last by the terms of which reparations for tonnage losses suffered were to be placed in a class by themselves and not treated like other claims for damages suffered during the war. This pact further provided that each of the victorious nations should retain all the enemy ships which had been acquired prior to the armistice. The balance were to be placed in a common pool and divided proportionately among the Allied and Associated Powers in accordance with their respective losses. Should any country's share under this percentage division plan prove to be greater than the number of ships captured by it, the nation in question was to be allotted additional tonnage from the general pool of enemy vessels. On the other hand, were the ships seized to exceed the share to which any individual country was entitled, that ally could retain all the vessels in its possession but would have to pay into a reparation pool the full value of such shipping.

In addition to Great Britain and the United States the Wilson-Lloyd George convention has been unqualifiedly accepted by Italy and Japan. After having given her consent some time ago to the clause allowing a nation to retain all the ships seized by it prior to the armistice, France has suddenly refused to agree to the remainder of the proposed terms of division which would give her only 250,000 tons of shipping as compared with 910,000 tons lost. The French authorities charge that a secret convention exists between England and Italy by which the former has promised to make good in kind all the latter kingdom's maritime losses amounting to 700,000 tons. They are demanding the treatment of maritime on the same basis as other reparation claims, which would result in the full replacement of the 910,000 tons of shipping lost by French shipowners during the war. As France has had to bear the heaviest burdens of all the Allies in the course of the late conflict, it would be a most unjust proceed-

ing to refuse her full reparation for her shipping while replacing all of Italy's lost tonnage.

The Reparations Commission must therefore determine whether the Wilson-Lloyd George agreement can take effect without the consent of France. In the event of its deciding this question in the negative, some other plan for the division of German shipping among the Allies will have to be worked out. As the United States has already its full share of German ships, its interests are in no wise affected by the present controversy which affects France and England primarily.—*The Nautical Gazette*, Jan. 3, 1920.

NAVAL CONSTRUCTION IN 1919.—It is now possible to announce, on the authority of the French Ministry of Marine, that the four battleships of the *Normandie* class are to be proceeded with. The original design has been altered very considerably, as will be seen by the following table:

	Original design.	New design.
Armament.....	Twelve 13.4in.	Twelve 13.4in.
	Twenty-four 5.5in.	Eighteen 5.5in.
Speed.....	21 knots	25 knots

Furthermore, the new design provides for special anti-torpedo protection not included in the first plans. Apparently the displacement is to remain at 25,230 tons and the length at 574 feet, though it is doubtful whether these measurements will be compatible with the much higher speed which is projected. Apart from the four battleships, which were laid down as long ago as 1913, French production has been confined to *poussière navale*, such as sloops, gunboats, etc. The sloops are admittedly modelled on British designs, but are, nevertheless, improvements on our *Flower* class, and should prove useful for such duties as training *personnel* and showing the flag. It is understood that several of them are propelled by Diesel engines. Two large submarines, *Fulton* and *Regnault*, were launched in 1919.—*The Engineer*, Jan. 2, 1920.

GREAT BRITAIN

SOME NAVAL WAR FIGURES.—The magnitude of the operations carried on by the British fleet during the war has been indicated by the recently published expenditures during the four years of the conflict. In the year 1915-16, the expenditure was $1,028,500,000; in 1916-17, it was $1,049,250,000; in 1917-18, it was $1,136,850,000; in 1918-19, it rose to $1,625,000,000, and at the time of the armistice in November, 1918, the naval expenses were running at the rate of $33,750,000 a week, or at the rate of one and three-quarters billions of dollars a year.—*Scientific American*, Jan. 31, 1920.

ADMIRALTY POLICY.—Although at the close of the year the First Lord indicated that the Admiralty had not yet decided upon a policy, it must be obvious that certain general principles have been arrived at in this respect. It can hardly be disputed that there is no immediate demand for a shipbuilding program, as in all classes of surface ships and submarines the latest units supplied to the fleet during the war give us an absolute superiority. There is nothing on the naval horizon which at all suggests that it will be necessary for us to be dissatisfied with what we have already got for some time to come. With the ordinary rates of construction in this country we have always been able to build faster than any other nation, and thus, so far as large ships are concerned, there would be time for us to begin anything of the kind, if it should be shown to be necessary, and complete it before the need for its use arrived. This may not be the case with smaller vessels, but here also it would be surprising if British shipbuilders were to allow themselves to be outpaced. The Admiralty, therefore, have a breathing time or, as some people might describe it, a naval holiday before them; on the other hand, it is absolutely

necessary that continued research and experiment should be made in respect to the possibilities of both aircraft and submarine attack. There can be no question that very long strides have been made, both in regard to defensive and offensive measures, to meet the threats from the air and from under water, especially the latter, but continued experiments and trial is necessary to enable the fleet to meet the developments in both these directions. Thus a policy is more or less defined, which it will be very difficult for the naval authorities to get away from.—*The Army and Navy Gazette*, Jan. 3, 1920.

A POWERFUL DESTROYER.—What is described as the " most modern and most powerful destroyer in existence" by British service papers is the destroyer *Wivern*, recently completed at East Cowes, Isle of Wight. She was laid down on August, 1918, and is of 1450 tons displacement and 28,000 shaft horsepower. The ship is capable of carrying some 400 tons of oil fuel, which will enable her to run about 1000 miles at full speed. The *Wivern's* armament consists of four superimposed 4.7 inch guns fore and aft, with fire control and director gear; two anti-aircraft high-angle quick-firing guns on an elevated platform amidships, and two sets of triple torpedo tubes mounted on revolving platforms. The living accommodation for officers and crew surpasses that of most destroyers, the firm having consistently made this a special feature of their construction. Her full power trials off the south coast of the Isle of Wight were entirely satisfactory, when she attained an average speed of between 34 and 35 knots. The *Wivern's* twin screws are driven by a double set of Brown-Curtis geared turbines. Steam is generated in three water tube boilers, each developing over 9000 shaft horsepower.—*Army and Navy Journal*, Jan. 24, 1920.

FAST LIGHT CRUISERS.—Late information shows the light cruisers to be vessels of a remarkable type. Their dimensions are as follows: Length, 565 feet; breadth, 54 feet 6 inches; depth, 30 feet 7 inches; the displacement being approximately 6000 tons. A battery of seven 6-inch guns will be mounted. The *Enterprise* will be propelled by four sets of Brown-Curtis geared turbines, installed in two separate compartments and actuating four screws. Each set of turbines consists of a high-pressure and low-pressure ahead turbine, with an astern turbine incorporated in the exhaust casing of the low-pressure ahead turbine. No less a figure than 80,000 shaft horsepower is specified in the contract, which should result in a speed of at least 34 knots, and probably more. The *Enterprise*, of only 6000 tons, will thus have engines capable of developing 10,000 units of power more than those of the battle-cruiser *Lion*, of 26,350 tons. There could be no clearer testimony to the wonderful progress achieved by British marine engineering in the past few years.—*The Engineer*, Jan. 9, 1920.

CRUISERS AS MERCHANTMEN.—Among the various expedients which have been adopted to relieve the prevailing dearth of marine tonnage, the conversion of warships into cargo vessels is not the least remarkable. The practice is not new, but instances of it have been rare in modern times. Now, however, a considerable number of old vessels are undergoing transformation to fit them for the carriage of goods and passengers, and the outcome of the experiment will be watched with interest. In ordinary circumstances, this policy would have little to recommend it. The average warship, with its minute subdivision and cramped interior, offers no facilities for the stowage of cargo, and the work of removing bulkheads, building cargo holds, fitting hatches, etc., is necessarily tedious and expensive. Then, again, the machinery is generally much too powerful to admit of its being worked on the economical basis which is a *sine quâ non* in the mercantile service. Consequently, it has to be modified, if not entirely replaced by more suitable engines. But at the present time, when tonnage

is at a premium, all these disadvantages are held to be outweighed by the supreme need of reinforcing the carrying fleet. It is not commonly known that one of the first warships to be converted into a merchantman during the late war was a British cruiser, the *Charybdis*. Built some twenty-five years ago under the Naval Defence Act, this vessel was considered unsuitable for active war employment, and in 1915 or 1916 it was decided to transfer her to the merchant marine. After being practically gutted and having several boilers removed, she was placed in service as a freight and mail steamer on the New York-Bermuda route in 1918, and is understood to have proved very useful in this capacity. In 1917 the United States Government similarly converted the old cruiser *Boston*, an example that was followed by several of the South American navies in the case of their old war vessels. France, it is reported, now contemplates a large program of the same character, having been encouraged by the success which has attended the alteration of the cruiser *Dupuy de Lôme*. This vessel, now thirty years old, was a famous ship in her day. Ordered by Admiral Aube, she embodied many of the features advocated by the "Jeune Ecole," of which he was a leading partisan. Although the displacement was kept down to 6400 tons, she carried a powerful armament, and had a speed of 20 knots. The entire hull was plated with armor sufficiently thick to keep out H.V. shell. Her distinguishing peculiarity was the enormous "ram" which projected nearly 40 feet beyond the bow, and was really designed to give support to the forward 7.6-inch gun. Shortly before the war she was sold to Peru, but the transaction was not completed. The task of reconstructing this ship was undertaken last year by the Chantiers de la Gironde, of Bordeaux. A saving in weight of 3200 tons was effected by removing twenty-six boilers—leaving only six in place—and stripping the 17½-foot belt of 4-inch armor from the hull. It is not known whether the protective deck was taken up, but it probably was. In her new guise, the *Dupuy de Lôme* has a load capacity of 4900 tons and can steam at 9 knots. She has been purchased by a Franco-Belgian concern, and will shortly make her first voyage as a merchantman. The Ministry of Marine, has now ordered the cruisers *Dupleix*, 7700 tons. *Brix* and *Letouche-Treville*, 4750 tons, to be rebuilt as store ships and fuel carriers, and it is expected that the larger vessels of the *Gloire* and *Montcalm* classes will be utilized in the same way. Admiral Daveluy has recommended that the cruiser *Jules Michelet*, of 12,600 tons, be converted into a 15-knot liner, but an alternative proposal is to transform this vessel into an aircraft carrier, fitted with anti-torpedo bulges.—*The Engineer*, Jan. 9, 1920.

REDUCTION OF THE BRITISH NAVY.—In connection with the cutting down of the dockyard establishment at Portsmouth certain local inquiries have elicited the fact that the post-war strength of the British Navy (after the ratification of the Peace Treaty by the United States), will be fifty to sixty thousand for the navy, and ten thousand for the marines. This was first published in the Portsmouth *Evening News*, and was generally commented upon by the press, and information was requested by the press from the Admiralty. Any such figures were officially denied, but no definite information was published in place of these figures.

The letters of Admiral Fisher, protesting against the size of the present navy's expenditures, have appeared in the *Times* under the heading: "Sack the lot." Admiral Fisher's articles were directed primarily against the size of the administrative staffs, etc. He was strongly in favor of scrapping obsolete matériel, and going to very advanced types. With economy so necessary at this time he is in favor of laying up or scrapping large numbers of the older ships, but his strongest plea is for cutting down the size of the Admiralty establishment.

Arthur Pollen has been very close to Admiral Beatty in times past, and upon Admiral Beatty's appointment to the Admiralty he looks forward in

this article to the work which Admiral Beatty will do in reducing the navy and in effecting drastic economies. It seems safe to suppose that Mr. Pollen would not write in this vein unless he were fairly certain that Admiral Beatty is one who will undertake a reduction of the navy in a very serious way. Pollen's article contains, like all his writings, allusions to increasing efficiency by improving matériel and particularly fire control methods. With improved methods the navy could be made very small, he thinks.

It appears, therefore, that the press generally believes from figures alleged to have been let drop by the Admiralty that a reduction to something on the order of fifty thousand is to be announced after the ratification of the Peace Treaty by the United States. The Admiralty will not publicly commit themselves at this time. The figure looks pretty low. It is certain, however, that drastic economies will come.

NAVAL CONSTRUCTION IN GREAT BRITAIN IN 1919.—Had the war continued for twelve more months, the year 1919 would probably have established a record for the production of naval tonnage. On the eve of the armistice warships of every description were being built in large numbers in Great Britain; the United States of America and Germany; while the corresponding effort of other belligerent powers was limited only by their resources. The conclusion of hostilities naturally led to an all-round reduction of these plans, entailing the abandonment of numerous vessels, for which there was no longer a demand. To illustrate the immense scope of international warship building in 1918, the following figures may be quoted: In November of that year Great Britain had on order 302 warships and 806 naval auxiliaries; the United States was building hundreds of destroyers, submarines, minesweepers and patrol craft, and had placed contracts for many capital ships and light cruisers, the execution of which was deferred in order to enable the shipbuilding industry to concentrate on destroyers and other craft urgently required to circumvent the submarine menace. Germany was launching submarines at the rate of two per week, and had just ordered 437 additional boats. She was, as well, building at a more leisurely pace two battleships, four battle-cruisers, about twelve light cruisers, and a swarm of surface torpedo craft. Immediately after the armistice, the British Admiralty cancelled the contracts for 218 war vessels and 696 auxiliaries; the United States also took steps substantially to reduce their program; and Germany was compelled by the armistice terms to suspend naval construction forthwith. Notwithstanding this universal deceleration of output, a large amount of tonnage remained to be completed, so that the past year was one of great activity in the naval shipbuilding world.

The only capital ship which remains to be delivered is the battle-cruiser *Hood*. She was due to leave Clydebank for her trials last November, but having been somewhat delayed is not expected at Devonport until early in the present month—January. Three sister ships—*Anson*, *Howe* and *Rodney*—were on the stocks in November, 1918, but were subsequently cancelled. As we so recently published a complete description of the *Hood*, it is not necessary to recapitulate all the points of this notable ship. She is by far the largest vessel in the Royal Navy, her displacement of 41,200 tons giving her an advantage of 13,700 tons over the *Queen Elizabeth*, 12,700 tons over the *Tiger*, and 15,450 tons over the *Royal Sovereign*. She is 110 feet longer than the *Renown*, hitherto the longest ship in the navy, and her breadth is no less than 104 feet. In other respects, however, she is not visibly superior to her immediate predecessors. The machinery is designed to work up to 144,000 shaft horsepower for a speed of 31 knots, which is 1½ knots less than the actual speed of the *Renown*. Nor is the *Hood's* armament particularly sensational, consisting as it does of the eight 15-inch guns which have become the standard main battery of our capital ships. As regards weight, the secondary armament of twelve

5.5-inch guns is not so powerful as that of earlier vessels. Where the *Hood* is understood to score is in her protection against gunfire and underwater attack, and the great weight of armor and bulkheading worked into the ship probably accounts for an extremely large percentage of her displacement. She is supposed to embody much of the dearly purchased experience of Jutland, which revealed a number of unexpectedly vulnerable points in our battle-cruisers of pre-war design. The *Hood's* gunnery and fire-control equipment presents several novel features, and includes the longest base rangefinder ever mounted afloat. Her total cost is estimated at £6,025,000, and the annual cost of maintenance in full commission at £539,000.

During the past year many new light cruisers were delivered to the navy, and others are still in the builders' hands. The largest vessel to be completed was the *Hawkins*, built at Chatham Dockyard. She was commissioned in the early autumn as flagship of the China Squadron, on which station she has since arrived. A full description of this vessel was published in *The Engineer* of Sept. 26, 1919. The *Raleigh* class to which she belongs consists of four vessels. The nameship was put afloat by W. Beardmore & Co. last summer, but neither the *Effingham* nor *Frobisher*, which are being built at Portsmouth and Devenport respectively, has reached the launching stage, though both are eventually to be completed. Specially designed in 1915 for ocean work in any part of the world, the dimensions of the *Raleigh* class are greatly in excess of the light cruiser average, and as applied to them the term "light cruiser" is obviously a misnomer. Their length overall is 605 feet, the displacement 9750 tons, and the legend speed at load draught 30 knots. They were originally designed to burn coal and oil, but this plan was afterwards altered in three ships of the class to the all-oil principle, the original figure of 60,000 shaft horse-power being increased by some 10,000 units as a result of the change. With their high speed, great fuel endurance, and battery of seven 7.5-inch guns, these cruisers should prove a terror to future commerce raiders of the *Moewe* type. They are expensive ships, however, the bill for the *Hawkins* amounting to £1,611,839, that for the *Raleigh* being about £150,000 less.

With the exception of *Hawkins*, all the light cruisers completed in 1919 were of the "C" or "D" class, viz.: *Cairo*, *Calcutta*, *Colombo*, *Delhi* and *Dunedin*. Both classes were evolved from the *Arethusa* prototype, and represent a powerful combination of speed and 6-inch gun-power. As sea boats, however, they are less satisfactory. Those of the "C" class average 4190 tons. They are fitted with oil-fired boilers and geared turbines of 40,000 shaft horsepower. The *Carlisle*, running her trials a year ago, worked up to 40,930 shaft horse-power and 28.45 knots on the measured mile, but others of the class have bettered this performance. The only "C" cruiser not yet finished is the *Cape Town*, which was launched at Birkenhead in June, and has lately been towed to Pembroke Dockyard for completion. Three vessels of the "D" class still to be completed are the *Durban*, *Despatch* and *Diomede*, all of which have been transferred to Royal yards to be equipped for sea. The average displacement is 4700 tons, speed 28-29 knots, and each vessel is armed with six 6-inch guns. Four other "D" cruisers were ordered, viz.: *Daedalus*, *Daring*, *Desperate* and *Dryad*, but have not been proceeded with. A new light cruiser class will come into being with the delivery of the *Emerald* and *Enterprise* which are being built respectively by Armstrong-Whitworth and J. Brown & Co. Designed for practically the same speed and armament, they are somewhat larger than the "D's," and, having a higher freeboard, especially forward, should prove superior in sea-going qualities. At no previous period in its history has the Royal Navy possessed so many modern, fast and efficient cruisers as it does to-day. Over sixty of these vessels are built or completing. The oldest was launched nine years ago, the speeds

range from 25 knots upwards, and even the smallest cruiser carries at least two 6-inch guns.

Between forty and fifty torpedo-boat destroyers were added to the navy during the past twelve months, all of them having been laid down prior to the armistice. Nine flotilla leaders were delivered within the same period. The latter are very powerful vessels which would have been rated as third-class cruisers a decade ago. The designs differ in small details, but the *Malcolm* is typical of our latest flotilla leaders. This vessel was commissioned only a few days ago, after completing very successful trials in the Clyde. She was built by Cammell-Laird, the firm which has constructed so many fine flotilla leaders, including the *Swift*. Her dimensions are: 320 feet by 31 feet 9 inches by 10 feet 6 inches; displacement, 1801 tons; oil-burning boilers; geared turbines of 40,000 shaft horsepower; speed, 36.5 knots; oil capacity, about 500 tons; armament, five 4.7-inch guns, director controlled, with one 3-inch A.A. gun, and six 21-inch torpedo tubes on triple turntables. The *Malcolm*, with her sister ship *Mackay*, are understood to have exceeded the designed speed on trial. The largest destroyers completed in 1919 were boats of the improved "V" and "W" type. They average 1300 tons, and have turbines of 27,000 shaft horsepower for a speed of 34 knots, which, with 400 tons of oil in the tanks, can be maintained for a distance of 1000 miles. Four 4.7-inch guns are mounted on the center line, complete fire control and director gear, besides an A.A. gun and six torpedo tubes. Accommodation is provided for a ship's company of 130. The smaller and faster "S" and "T" classes were also represented among the year's deliveries, of which, indeed, they formed the bulk. There are minor variations in the general design of these two classes, but the following dimensions, etc., may be taken as approximately correct for the entire group: Length, 265 feet; displacement, 1065 tons; engines of 27,000 shaft horsepower; speed, 36 knots; armament, three 4-inch guns, one 2-pdr. A.A. gun, four 2-inch torpedo tubes. It will be noticed that the power developed by the machinery of these boats is equivalent to that of the heavier "V-W" type, and consequently the speed is higher. Among the latest of the 1919 "T" boats were the Yarrow-built *Turquoise* and *Tyrian*. The former made 39.6 knots on the measured mile, while the *Tyrian* reached 39.4 knots on an Admiralty four hours' run in deep water. This is said to be the highest authenticated speed ever maintained in similar circumstances. The *Torbay* and *Tourmaline* are two vessels of the same class launched during the year by John I. Thornycroft & Co., Ltd., builders of the 40-knot *Teazer*. By one of fate's ironies, all these new deliveries have brought up the destroyer establishment to a huge total at a time when the *personnel* of the navy has been greatly reduced by demobilisation. It is impossible, therefore, to keep all the new boats in commission, and there will be no alternative but to place the majority in reserve.

Submarines, too, were delivered in large numbers during 1919. They included four boats of the well-known "K" class "steamers," which are capable, by virtue of their great size and 24-knot speed, of going to sea with the Battle Fleet and taking part in all its evolutions. Oddly enough, while four "K" boats were completed in 1919, two earlier units of this class were placed on the sale list. One can only assume that these two had revealed defects which justified their summary condemnation. The navy seems to have adopted the "L" class as its favorite type of large sea-going submarine, as twenty-four of these boats were completed in the period under review, and more are to come. As described by Sir E. H. Tennyson d'Eyncourt, the typical "L" submarine is a boat 231 feet long overall, with an extreme breadth of 23 feet 6 inches and a mean load draught of 13 feet 6 inches, displacing 800 tons on the surface and 1070 tons submerged. The Diesel engines used for surface propulsion are of

2400 horsepower, and give a speed of 17¼ knots, while electro-motors of 1600 horsepower drive the boat at 10½ knots in submerged trim. An oil capacity of 76 tons confers a very wide radius of action. The armament comprises one 3-inch or 4-inch gun and six 18-inch torpedo tubes. With few exceptions, all British submarines have tubes of that caliber, whereas the German practice was to install 19.7-inch torpedoes, which are naturally much more destructive. The difference may explain why so many enemy vessels torpedoed by our submarines contrived to reach port, whereas a German torpedo usually administered a mortal blow. Certain of the "L" boats completed last year were specially fitted for mine-laying, and in them the torpedo armament is reduced. In addition to "K" and "L" boats, a series of "H" submarines hoisted the White Ensign last year, being the latest members of a very numerous war-time class. Although based on the original American design, the British-built "H" submarines have undergone certain modifications, and in spite of their modest dimensions—171 feet long, 500 tons submerged displacement—they are well liked in the service. Their speed above water is 13 knots, and they carry the formidable armament of four 21-inch tubes. The "R" boats, of which six or seven were completed during the year, are faster below water than above, and were built with the object of hunting enemy submarines. The *M-1*, our first "submarine monitor," was completed before the armistice, but her two sisters, *M-2* and *M-3*, are not yet finished. It is uncertain whether they are exact replicas of the *M-1*, which mounts a long-range 12-inch gun than can be aimed and discharged when the vessel is practically submerged. It has been rumored that the later "M's" may carry guns of still greater power, but details are unobtainable. In any case, the *M-1* may prove historic as the forerunner of the submersible mastodons which many naval students believe will supersede the floating capital ship.

No review of the past year would be complete without some allusion to the navy's aircraft carriers. Two of these vessels are being completed, the *Eagle* being so far advanced that she is expected to begin her trials in the early spring. She is now at Portsmouth Dockyard, having been towed there from Elswick, where she was built. Armstrong, Whitworth & Co. also built the *Hermes*, the second ship of this type, albeit considerably smaller. She is being finished off at Devonport. It is commonly supposed that the *Eagle*, which was laid down as the Chilean battleship *Cochrane*, is merely a duplicate of the *Canada—ex Latorre*—originally her sister ship, but without the latter's armament. This is incorrect. When it was decided to convert the *Eagle* into an aircraft carrier, important changes were made in the design, the displacement being reduced from 28,000 to 26,200 tons, while the shaft horse-power of the machinery was increased from 37,000 to 55,000 units, thus raising the speed from 22¾ to 24 knots. In her new guise the *Eagle* will have only one funnel, which, placed as it is on the extreme starboard beam, will leave the whole of the port side of the deck clear for aeroplanes to take off and alight. The *Hermes* might not improperly be styled an aircraft cruiser, since her displacement is only 10,950 and her speed 25 knots. Her cruiser character is accentuated by the armament of ten 6-inch guns and four 4-inch A.A. guns. She may also be equipped for sowing mines and firing torpedoes. Broadly speaking, she is an up-to-date edition of the French *Foudre*, launched some twenty-five years since.

From the foregoing summary of a year's progress, it will rightly be inferred that British naval construction followed more or less conventional lines, and has not yet responded to the influence of the ultra-modern school of thought, which regards the battleship as already dead and pins its faith

wholly to aircraft and submersibles. At the same time, the provision of aircraft carriers, on the one hand, and of a few "submersible monitors," on the other, shows that the British Admiralty is by no means blind to the possibilities of the new factors in naval warfare.—*The Engineer*, Jan. 2, 1920.

BLUEJACKETS' ARMCHAIRS.—The report that armchairs are to be supplied to certain ships for the use of petty officers and men is the subject of an interesting interview with Admiral the Hon. Sir Edmund Fremantle. While not objecting to innovations designed to promote the comfort of the men of the lower deck, Sir Edmund remarks upon the contrast which such a proposal presents to the conditions prevailing seventy years ago and imagines that Nelson would have replied to a suggestion of the kind in his day that there was no room for luxuries in the navy. This seems a debatable point concerning a leader of whom it has been said that he never flogged a man, and who was beloved by all ranks; certainly he would not oppose the change if he were living in the conditions at the present time. This concession to the desire for a greater degree of comfort—it can scarcely be called luxury—promotes the welfare of our seamen in the truest sense and should be an eye-opener to those narrow-minded folks who seem to think that the work of a welfare committee begins and ends with £ s. d. A considerable proportion of the requests put forward under the new scheme deal with comfort, sanitation, hygiene and matters connected with the improved habitability of ships of war. Under the guidance of Lord Beatty, the Board may be depended upon to deal with such requests in a manner as sympathetic and considerate as the needs of the service will permit.—*The Army and Navy Gazette*, Jan. 3, 1920.

JAPAN

NAVAL CONSTRUCTION IN JAPAN IN 1919.—No large warships were completed for the Japanese Navy during 1919, but the *Nagato* and *Mutsu* are well advanced and two new capital ships, the *Kaga* and *Tosa*, were to have been laid down in September. As the Japanese authorities are distinctly reticent as regards their latest ships, practically nothing whatever is known about the *Nagato* and her consorts; it is even uncertain whether they are battleships or battle-cruisers. The light cruisers *Tatsuta* and *Tenriu*, which are very similar to our early "C" class, have been completed; while the *Kuma*, which is understood to be a larger ship, was launched at Sasebo in June. Four other light cruisers are on the stocks. Among the destroyers launched or completed in the year were six of the *Minekaze* class, which are almost twin sisters to our "V" boats. They are of 1345 tons, 34 knots speed, and mount four 4.7-inch guns and six torpedo tubes. There is no reliable intelligence about Japanese submarine construction, but Nos. 14 and 22 to 26 are reported building or completing.—*The Engineer*, Jan. 2, 1920.

A DEPOT SHIP OF THE NEW AEROPLANES.—The construction of a depot ship for aeroplanes from which aeroplanes can be launched from the deck by using hydraulic power, has heretofore been used with success only by the British Navy. After various investigations in this matter our navy has succeeded in perfecting a depot ship of this type.—*Osaka Mainichi*, Dec. 4, 1919.

GREAT SEA BARRIER HELD BY JAPAN.—Close study of the military situation throughout the world in the light of recent important changes in the military and political situation is being made by military experts and diplo-

mats in Washington, who are especially concerned over the spread of Bolshevist militarism, and speculating as to the rôle Japan will play in the changed situation.

The important alterations in the general situation are the collapse of the Russian anti-Bolshevist movement; the rapid spread of the Red armed menace toward Japan, China, India, Persia, and Western Europe; the decision of the American Government to withdraw its army from Siberia, which in turn has developed a new and unexpected situation for the Japanese; important changes in the map of the Pacific as a result of the ratification of the Versailles Treaty, which has given Japan certain important geographical advantages, and the imminence of a concentrated military attack by the Bolshevist army against Poland.

The Japanese Government has not yet indicated what its attitude will be toward the Siberian situation, whether Japanese troops will be left in their present status in Siberia and Manchuria, or whether they will be withdrawn or greatly increased, and in its decisions as to changes in the status quo in the Orient the Tokio Government will act after conversations with the British Government, with which it has a treaty of alliance.

Viscount Uchida, the Japanese Foreign Minister, was scheduled to address the National Diet at Tokio Jan. 20, on Japan's policies, discussing the Siberian and Shantung questions, as well as Japan's international relations in general. Premier Hara and the Finance Minister were also to address the Diet to-day.

The study that has been made of the military situation considering the world as a unit, has convinced military experts that it pivots very largely around the fact that Japan is in a greater position for military offensive and defensive operations at the present moment than ever before in history. The outstanding fact is declared to be that Japan is the only great power with a large national army that can be quickly mobilized and thrown into war anywhere at will. Before the outbreak of the World War in 1914, there were other nations that could use their armies at will, notably Germany and Austria, but they cannot longer do so. Japan is the single remaining great power that is not hedged around by the check against using the military forces without express approval of legislative bodies.

Military experts have also discovered that a second important element of power is possessed by Japan through the acquisition of the Pacific Islands north of the equator. These have furnished Japan with an insular barrier of defence against naval attack which is regarded now in the highest military circles as giving her control over the whole Pacific Ocean front of Asia.

This barrier starts with the Kurile Islands near Kamchatka. These link up with the empire of Japan proper which extends to the island of Formosa, off the coast of Duchau. The chain extend via Bonin, the Ladrones, Mariane, and Caroline islands east of the Philippines to Micronesia. With possession of the Pacific islands north of the equator, Japan now has a complete natural insular barrier which she is understood to be planning to utilize in setting up an elaborate system of submarine torpedo-boat defence.

Japan is known to be making an intensive study of the possible use of submarines based on this long chain of islands, is training submarine officers, and making a special study of the operations of German submarines in the World War. These newly acquired islands, in conjunction with those which were previously owned by Japan, are regarded as giving that nation immunity from naval coercion by sea, and the opportunity to throw a submarine barrier between the United States and the Philippines.—*New York Times*, Jan. 21, 1920.

UNITED STATES

VESSELS BUILDING

NAVAL CONSTRUCTION IN THE UNITED STATES IN 1919.—The latest intelligence regarding the program of naval shipbuilding in the United States is contained in the Naval Secretary's annual report, a summary of which has now been received. At the present moment there are under construction or contract 12 battleships and 6 battle-cruisers. The secretary states that as a result of information gleaned during the trip to Europe which he made last year with Admirals Taylor, Griffin and Earle, the Navy General Board unanimously recommended that all the battleships should be completed as rapidly as possible "on present lines of development." It is not altogether clear from this statement whether the vessels are to be completed according to the original design or whether the plans are to be modified. As for the six battle-cruisers, the General Board advised their speedy completion, but urged that they should be given additional protection, "particularly to turrets, conning-towers, magazines, and communications, at the expense of a small reduction in speed." It appears that the new American battle-cruisers will have a service speed of only 33 knots instead of 35 knots as first designed. In the original project half the boilers were to have been placed above the water-line, but there is reason to believe that the criticisms which this proposal naturally evoked have led to a rearrangement of the boiler installation. The displacement is said to have been altered from 35,300 to 43,500 tons, and the main armament from ten 14-inch to eight 16-inch guns. Deliveries during the 12 months ending October 1, 1919, included 1 battleship, 103 destroyers, 32 submarines, and about 120 patrol and auxiliary craft. Although the orders to accelerate the completion of destroyers were cancelled after the armistice work on this class of vessel had been thoroughly organized at that date, and deliveries have been on a large scale in the past year, now averaging 10 per month. Mr. Daniels speaks with pardonable pride of his country's great achievement as regards the war emergency program, and quotes some imposing figures to show the immense increment of strength which the navy has received.

"When the vessels now building or under contract are completed," he writes, "the propelling power of our ships will be five times as great as it was prior to the war. The addition represented by the destroyers alone will reach 8,000,000 horsepower. To drive these destroyers at the high speed of 35 knots—40 miles an hour—required engines of 27,000 to 28,000 horsepower, as much as is required to propel a dreadnought like the *Utah*. . . . . To drive the huge new 43,500-ton battle-cruisers through the water at 33 knots, will require the largest propelling force ever placed in any vessel—engines developing 180,000 horsepower, a total of 1,080,000 horsepower for the six to be built. . . . . The ten scouts will have an aggregate of 900,000 horsepower. With these additions, the machinery of the fleet will have a total propelling force of 13,000,000 horsepower—eight times as great as that of all the passenger-carrying ships that ply the Atlantic, including the big former German liners." Mr. Daniels' reports are invariably full of interest and information, and the only quarrel we have with him is that he persistently speaks of "dreadnoughts" and "superdreadnoughts." Modern naval nomenclature contains many unpleasing composite words, but "superdreadnought" is, we submit, *le comble!*—*The Engineer*, Jan. 9, 1920.

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, AS REPORTED JANUARY 31, 1920

Type, number and name	Contractor	Per cent of completion			
		Feb. 1, 1920		Jan. 1, 1919	
		Total	On ship	Total	On ship
Battleships					
43 Tennessee	New York Navy Yard	98.1	95.1	96.	92 3
44 California	Mare Island Navy Yard	88.9	82.8	87.2	80.7
45 Colorado	New York S. B. Cpn.	42.2	25.9	40.2	23.3
46 Maryland	Newport News S. B. & D. D. Co.	63.	55.8	60.	52.6
47 Washington	New York S. B. Cpn.	40.3	23.9	38.9	22.2
48 West Virginia	Newport News S. B. & D. D. Co.	27.	5.8	27.	4.2
49 South Dakota	New York Navy Yard	7.1	.6	5.6	.4
50 Indiana	New York Navy Yard	7.1	.6	5.6	.4
51 Montana	Mare Island Navy Yard	5.	.5	3.	0.
52 North Carolina*	Norfolk Navy Yard	5.3	.9	3.8	.3
53 Iowa	Newport News S. B. & D. D. Co.	....	....	....	....
54 Massachusetts	Beth. S. B. Cpn. (Fore River)	....	...	....	.....
Battle Cruisers					
1 Lexington	Beth. S. B. Cpn. (Fore River)	Material being received			
2 Constellation	Newport News S. B. & D. D. Co.				
3 Saratoga	New York S. B. Cpn.	.1	.1		
4 Ranger	Newport News S. B. & D. D. Co.	Material being received.			
5 Constitution	Phila. Navy Yard				
6 United States	Phila. Navy Yard				
Scout Cruisers					
4	Todd D. D. & Const. Cpn.	34.3	12.8	34.	11.5
5	Todd D. D. & Const. Cpn.	32.1	9.3	32.1	9.3
6	Todd D. D. & Const. Cpn.	26.3	2.2	24.	2.
7	Beth. S. B. Cpn. (Fore River)	3.9	2.1	3.5	1.8
8	Beth. S. B. Cpn. (Fore River)	3.9	2.1	3.5	1.8
9	Wm. Cramp & Sons Co.	26.	....	23.	....
10	Wm. Cramp & Sons Co.	25.	....	22.	....
11	Wm. Cramp & Sons Co.	12.	....	8.	....
12	Wm. Cramp & Sons Co.	12.	....	8.	....
13	Wm. Cramp & Sons Co.	12.	....	8.	....
Miscellaneous					
Fuel Ship No. 17, Neches	Boston Navy Yard	55.	50.	48.3	41.7
Fuel Ship No. 18, Pecos	Boston Navy Yard	20.1	5.6	19.2	3.1
Gunboat No. 21, Asheville	Charleston Navy Yard	57.4	95.9	94.5	92.5
Gunboat No. 22, Asheville	Charleston Navy Yard	16.	14.	11.8	9.8
Hospital Ship No. 1, Relief	Phila. Navy Yard	70.5	66.5	66.5	62.5
Amm. Ship No. 1, Pyro	Puget Sound Navy Yard	99.2	98.	99.	97.5
Amm. Ship No. 2, Nitro	Puget Sound Navy Yard	90.	80.	85.	74.
Rep. Ship No. 1, Medusa	Puget Sound Navy Yard	22.	8.	16.	0.
Destroyer Tender No. 3, Dobbin	Phila. Navy Yard	12.	7.2	10.	5.2
Dest. Tender No. 4, Whitney	Boston Navy Yard	0.	0.	0.	0.
Sub. Tender No. 3, Holland	Puget Sound Navy Yard	0.	0.	0.	0.

* Keel laid January 12, 1920.

There are in addition to the above 105 destroyers, 51 submarines, 9 seagoing tugs, and 6 oil tankers in various stages of completion.

There were completed and delivered to the Navy Department during the month of January 4 destroyers, 1 submarine, 1 minesweeper, and 1 oil tanker.

There are 12 destroyers, 10 submarines and 1 transport (No. 2) authorized but not under construction on contract.

NAVAL POLICY

POLICY AS TO ARMY AND NAVY FUNCTIONS.—During the World War when all of our resources were being utilized to the utmost the navy as well as the army undertook the production of railway artillery, utilizing for that purpose guns already available. At the conclusion of hostilities a question arose as to what disposition should be made of seven 14-inch railway mounts which the Navy Department had manufactured. This was referred to the Joint Army and Navy Board, which formulated the following statement of the functions of the Army, Navy and Marine Corps. As a result of this naval railway mounts have been transferred to the army.

This important statement of policy, the office of the chief of staff announces, having been approved by the Secretary of War and the Secretary of the Navy, will govern in future plans and operations:

Naval Functions: (a) Battle Fleet. To gain and maintain command of vital lines of communication by sea, thus ensuring freedom of movement on the sea to one's own vessels, and denying such freedom of movement to enemy vessels. Such security of vital lines of communication can be obtained, usually, only by decisively defeating the enemy main fleet or containing it.

(b) Naval Coast Defence. (Submarines, mine-layers, mine-sweepers, monitors and obsolete ships assigned to local coast defences.) Control the sea communications within the area to which assigned. If the navy is inadequate to the task indicated above it must be used to prevent the enemy from obtaining control of vital lines of communication.

Army Functions: (a) To defend against invasion or capture the Continental United States and all localities in our possession which are permanently fortified or garrisoned in time of peace. (b) To operate offensively against enemy vital possessions or home territory when the navy has established control of the lines of communication and the military situation warrants. (c) To relieve marine garrisons from temporary bases seized by the fleet as soon as the line of communication has been made secure.

Marine Corps Functions: (a) Marine detachments on board vessels of the fleet continue as assigned. (b) Marine advance base detachments seize temporary bases in co-operation with the fleet, and defend such bases until relieved by the army.

From a consideration of the above stated functions of the several branches of the military and naval forces it appears that the handling of artillery on shore, except such as may be landed from ships and that pertaining to advance base equipment, is an activity of the army. The army is responsible for the adequate defence of all permanent *fortified* or garrisoned possessions of the United States. It is a function and duty of the Navy Department to inform the War Department of any places whose defence by the army is desirable, and to call attention of the War Department to any case where the provisions for defence by the army are considered inadequate from the naval point of view.—*Army and Navy Journal,* Jan. 31, 1920.

ARMY AND NAVY AIRCRAFT POLICY.—The policy of the army and navy relating to aircraft is announced in the following statement issued from the office of the chief of staff on Jan. 22. It has been approved by the Aeronautical Board, the Secretary of War and the Secretary of the Navy, and is published for the information and guidance of all concerned:

Aircraft to be used in the operations of war shall be designated: (a) Army aircraft; (b) Navy aircraft; (c) Marine aircraft. Army aircraft are those provided by the War Department and manned by army personnel. Navy aircraft are those provided by the Navy Department and manned by navy personnel. Marine aircraft are those provided by the

Navy Department and manned by Marine Corps personnel. The Marine Air Service is a branch of the Naval Air Service.

The functions of the army, navy and marine aircraft are:

Army aircraft. Operations from bases on shore: (a) As an arm of the mobile army; (b) against enemy aircraft in defence of all shore establishments; (c) alone or in co-operation with other arms of the army or with the navy, against enemy vessels engaged in attacks on the coast such as: (1) Bombardment of the coast; (2) operations preparatory to or of landing troops; (3) operations such as mine laying or attacks on shipping in the vicinity of defended ports.

Navy aircraft. Operations from mobile floating bases or from naval air stations on shore: (a) As an arm of the fleet; (b) for overseas scouting; (c) against enemy establishments on shore when such operations are conducted in co-operation with other types of naval forces, or alone when their mission is primarily naval; (d) to protect coastal sea communications by (1) reconnaissance and patrol of coastal sea areas; (2) convoy operations; (3) attacks on enemy submarines, aircraft or surface vessels engaged in trade prevention, or in passage through the sea area; (e) alone or in operation with other arms of the navy, or with the army, against enemy vessels engaged in attacks on the coast.

Marine aircraft. The functions normally assigned to army aircraft shall be performed by the marine aircraft when the operations are in connection with an advance base in which operations of the army are not represented. When army and marine aircraft are co-operating on shore the control of their operations shall be governed by the 120th Article of War.

The functions of aircraft assigned under army (c) and navy (e) are a duplication of functions. In such operations co-operation is vital to success. Such co-operation shall be governed by the following provisions: (a) The naval district forces, vessels and aircraft, will never be strong enough to prevent an attack on the coast by major units of the enemy fleet. When, therefore, an enemy force of a strength greatly superior to that of the naval force available for use against it approaches the coast the commander of the naval force shall inform the commander of the army department of the situation, shall assume that the army has a paramount interest in the operation, and shall co-ordinate the operations of the naval forces with those of the military forces. (b) If, however, the conditions are such that the enemy is, or can be, engaged by a naval force approximating in strength to that of the enemy, the commander of the army department shall be so informed and he shall assume the navy has a paramount interest in the operation and shall co-ordinate the operations of the military forces with those of the naval forces.

The functions of aircraft above assigned shall govern in the production of aviation equipment, training of aviation personnel and establishment of air stations for the War and Navy Departments. Such assignment shall not prevent the employment of army and marine aircraft in naval functions upon the request of the senior naval officer present, or vice versa, the employment of naval aircraft in army functions upon request of the senior army or marine officer present on shore; nor shall it prevent the employment of army, navy or marine aircraft when no other air service is co-operating in the operation, in any manner which shall be most effective in accomplishing the mission of the force.

All questions regarding the policy of the War and Navy Departments with regard to the tactical and strategical functions of aircraft, and to the location of air stations, shall be addressed to the Joint Board for consideration and recommendation to the Secretary of War and the Secretary of the Navy.

The name of the board now known as the Joint Army and Navy Board on Aeronautics is changed to the Aeronautical Board.

To prevent duplication, and to secure co-ordination, plans of new projects for the construction of aircraft, for experimental stations, for coastal air stations, and for stations to be used jointly by the army and navy, or for extensive additions thereto, shall be submitted to the Aeronautical Board for recommendation.

The development of new types of aircraft, or of weapons to be used from aircraft, so far as practicable, shall be assigned to and carried on by one air service. This restriction shall not prevent the employment by either air service of any types of aircraft or weapons, which, after development, are considered to be necessary for the accomplishment of its functions. Questions relating to the development of new types of aircraft or weapons to be used from aircraft shall be referred to the Aeronautical Board for recommendation as to which air service shall be charged with the development. All information pertaining to experiments in connection with aviation shall be exchanged promptly between the army and navy air services.

Whenever possible, training and other facilities of either air service shall be made available for, or be used by, the other service. Before arranging to purchase aircraft each service shall attempt to secure aircraft of the type desired from or through the other service. In the interests of economy, heavier-than-air craft shall be provided in preference to non-rigid, semi-rigid or rigid dirigibles whenever the former can satisfactorily perform the service required. All estimates of appropriations for the army and navy aviation programs shall be presented to the Aeronautical Board for review and recommendation before submission to Congress.—*Army and Navy Journal,* Jan. 31, 1920.

"SAO PAULO" SAILS FOR GUANTANAMO.—The Brazilian battleship *Sao Paulo,* which arrived at the New York navy yard soon after the declaration of war against Germany by the United States, has left the yard on her way to Guantanamo, where she is to join the United States Atlantic Fleet in the drills and evolutions. Before proceeding to Cuba she stopped at Gravesend Bay, New York, to take on ammunition. While at the yard the ship was completely overhauled, in the expectation that she would join the Allied fleet in the North Sea, much of her equipment having to be brought from England, where she was built. A number of the ship's officers were assigned to duty on American warships while the *Sao Paulo* was being made ready for her expected service with the Allies.—*Army and Navy Journal,* Jan. 17, 1920.

WOULD BAN EXPORT OF HELIUM.—Secretary Daniels has asked Congress to penalize the exportation of helium, a non-inflammable gas used for filling military balloons, because there is not enough of the product in this country to be divided with the demand abroad. He also asks for relief for war contractors suffering losses because of fixed price agreements with Uncle Sam.—*United States Bulletin,* Feb. 2, 1920.

FUTURE U. S. WARS MUST BE OFFENSIVE.—The Secretary of the Navy declares that the United States' plans for future wars must be made along lines of offensive warfare, in a contribution to the current number of *The Bulletin,* a publication issued by the Atlantic Coast Shipbuilders' Association. Asserting that the isolation of this country no longer exists, which fact was demonstrated by the swift sea transportation during the World War, he continues: "In case of war the United States cannot be subjected to a defensive campaign. That would lay our country open to invasion with resulting devastation. The preventive is to carry on an offensive rather than a defensive campaign. We are not now as strategically safe on account of isolation as we were in years past when transportation was so much slower. This line of defence is being reduced daily. If called upon to act we must act quickly and carry a possible war to the

strongholds of the enemy. This cannot be done unless our navy is supported by unfailing lines of communication which must be established by ships of our merchant marine. Our army cannot act unless it is transported in ships of the merchant marine.

"It would be impossible for the United States to maintain in commission, or in reserve, a fleet of transports sufficient to supply our needs in case of war. We cannot depend upon foreign countries for this assistance. During the recent war to transport our army and supplies overseas every available ton of the merchant marine of our allies was brought into use to assist our own small merchant fleet. If it had not been for this assistance the army would not have gone into action against the enemy until it might have been too late, as it would have been necessary to wait for new ships being built by the Emergency Fleet Corporation.

"In order to man vessels of the navy in time of war it is necessary to call into service a great number of men in addition to the peace-time organization. If the United States maintains an ample merchant marine seafaring men will, as a result, be available and we will not then be in the predicament we were at the beginning of the recent war. The lack of a merchant marine means loss of months of active duty against the enemy while fresh men are being trained for the duties which would be required of them on board the vessels of our fleets."

The Secretary concluded his statement by showing that the expansion of port facilities on the nation's seaboards would prove of the utmost value to the navy in time of war. He urged their enlargement to the greatest degree, saying that the existence of a large merchant marine, in itself, is an effective argument against aggression by any power.—*Army and Navy Journal*, Jan. 10, 1920.

AVIATION IN NAVAL ACADEMY COURSES.—The plan for inclusion of instruction in studies related to aviation, already described in the *Army and Navy Journal*, has been practically arranged by a board of officers at the U. S. Naval Academy. The plan has been approved by Rear Admiral Archibald H. Scales, Superintendent of the Academy. The complete exhibit of aviation material, collected under the supervision of Captain T. T. Craven who originally suggested the plan, includes a Liberty motor, a cross-section of the motor, other airplane engines, models of heavier-than-air and lighter-than-air craft, instruments used in navigating the air, a meteorological set, armament, gas accessories, etc. This material has been installed in the building occupied by the Department of Marine Engineering and Naval Construction at the Academy. Flying instruction is not contemplated at Annapolis, though there is some sentiment that it should be a part of the post graduate course. In this connection it is recalled that the first flying by officers of the navy was done at Annapolis, the school afterward being removed to Pensacola, Fla.—*Army and Navy Journal*, Jan. 17, 1920.

MATÉRIEL

CHARLESTON'S DRY DOCK HALTED.—Work on the proposed new dry dock at Charleston, S. C., has been suspended by the Navy Department pending the report of the Senate Special Committee, which is to make a personal survey of the project.—*The Nautical Gazette*, Jan. 24, 1920.

SHIPS THAT WE SHOULD BUILD.—Although the *Scientific American* has urged strongly that it would be folly to go ahead just now with the construction of the six 42,000-ton battleships, we would not have the impression go forth that we are opposed to all naval ship building. On the contrary, there are certain types of vessel of which the navy stands sorely in need, vessels without which it would still be characterized by that lack

of balance which was so glaringly manifest, and to which we so often drew attention, in the years preceding the war.

As matters stand to-day, we have no scout cruisers that are worthy of the name. The *Chester, Salem,* and *Birmingham,* which did good work during the war in escorting convoys, are too small and too slow to meet the exacting requirements of modern scouting service. The scouts of the British Navy have gone up in size to from 5000 to about 10,000 tons; they carry heavy armaments of 6-inch and 7.5-inch guns, and they have speeds of about 30 knots. High speed is an absolute necessity in ships that must scout far ahead of a fleet, say, of battle cruisers whose speed may range from 28 to 32 knots and who maintain high speed in any weather that comes their way. For this reason the scout must have length and weight.

Now we had made an excellent start before we entered the war by authorizing ten large and powerful scouts of 35 knots' speed, work upon which is now being prosecuted; but ten of these ships is not sufficient for a navy of our size, and an additional ten should receive the endorsement of Congress. Just what the present design of these scouts is has not been made known. The original design was not altogether satisfactory, there being some question of longitudinal weakness in the hulls; but we presume that has been set right and that we now have a standard design to which we can build in numbers.

Another type of greatly-needed vessel in our navy is what is called the flotilla leader. This is simply an unusually large destroyer of about 2000 tons' displacement. It is a development of the war, and on each side in the various engagements these vessels acted as the leaders and flagships of the separate flotillas of destroyers when going into action. Their greater size enables them to carry all the essential facilities aboard for a small flag ship, with accommodations of a flotilla commander. Compared with the destroyer, they have superior signalling and range-finding appliances, their battery is heavier, and they have a radio equipment of much greater range. Furthermore, when battle cruisers are using their full speed in an engagement, the average destroyer is rather put to it in the effort to match the battle cruiser's speed, and hence flotilla leaders, with their greater size, are selected to act as battle-cruiser screens on such occasions.

Finally, we should build a number of submarines of a more or less experimental type. The Board recommends, first, a submarine with a very wide radius of action, a heavy armament and the longest practical radio-sending range. Speed both on the surface and below would be sacrificed to other qualities, and the vessel would carry four bow and two stern tubes, fifteen 21-inch torpedoes, two 6-inch guns and an anti-aircraft gun. The length would be 300 feet and the surface displacement 2000 tons. It is also proposed to build a long-radius mine layer, similar to the *U-117;* and thirdly, we should build a "general purpose submarine" of about 900 tons, which should be the best combination that the Department can evolve as the result of past experiences gained with different designs of our own and German U-boats.—*Scientific American,* Jan. 17, 1920.

NAVAL BASES ON THE ATLANTIC SEABOARD.—The following, briefly, are good reasons why the principal bases for the American Navy have been developed along the Atlantic Seaboard. First, American interests on this coast are much greater than on any other. Here are our largest cities and principal industries. Second, most of the American shipping is in the Atlantic, and there most of the navy should be based. Third, the Monroe Doctrine aims to prevent European colonization in North or South America, and the approach to the Western Hemisphere must be made by way of the Atlantic. Fourth, because of the denser population on the Atlantic Seaboard, it is advisable that the bulk of our ships should be based on Atlantic ports. Moreover, the men are more content when their ship's base is convenient to their homes, a most important factor in morale and efficiency. Fifth, skilled artisans, supplies of material and the great

manufacturing plants are nearer the Atlantic than the Pacific Seaboard, and on this coast, therefore, the cost of repairs is considerably less.—*Scientific American*, Jan. 31, 1920.

FROM WAR TO PEACE IN NAVY YARDS.—It takes time to readjust such a vast industry as that of naval warship construction from a war to a peace basis. A large amount of scrapping of warships that were on the building ways and partially completed has to be done. This takes only little less time than their construction. Also, the governments that were at war are still using a large amount of warships and commercial vessels for meeting certain requirements and commitments in the various centers of conflict. A great amount of labor and time have been consumed in retransforming commercial ships from war-time to peace-time service. In some cases, notably in Great Britain, as soon as the naval shipbuilding ways are vacated, commercial ships have been laid down and many of these are well under way. Incidentally, it is interesting to note our contemporary, *The Shipping World*, is of the opinion that already there is more shipping afloat in the world than there was five years ago, and this notwithstanding the grievous losses due to war. On the other hand, the necessities of nations are greater to-day than they were in 1914, and hence a larger contingent is required to meet them.—*Scientific American*, Jan. 31, 1920.

NAVAL BASE AT SAN DIEGO PROPOSED.—The Secretary of the Navy at a meeting of the sub-committee of the House Committee on Naval Affairs on Jan. 12 advocated the development of a naval base at San Diego, Calif. On the following day, after consideration of the project, it was announced by Chairman Kelley that action was deferred on the matter because a private concern holds an option on a valuable tract of land adjacent to the property on which the Secretary advocated the construction of the base. "However, the committee later will go ahead with plans favorable to the proposed plan," said Mr. Kelley. "As it stands now there is a private concern building concrete ships at San Diego at the place where this proposed base may be located. Their contract runs out in May. From that month the concern holds a sixty-day option on the site. Provided the government is successful in obtaining the property there is a chance that a naval base would be built at San Diego." In connection with the establishment of the base it is proposed to remove the marine railway at San Diego across the bay to the property. The cost would be approximately $750,000. As noted in our issue of Dec. 27, a forthcoming Navy Department general order has been prepared relative to the establishment of a naval base at San Diego.—*Army and Navy Journal*, Jan. 17, 1920.

NAVY'S SALE OF SUBMARINE CHASERS.—Many of the submarine chasers built by the navy during the war are to be sold. All told 455 of these craft were constructed. These are sea-going wooden vessels, 110 feet long, fitted with three standard gasoline engines of 220 horsepower each. They have an auxiliary engine for generating electricity, air compressor and large bilge pumps. Many have full heating equipment and some have radio. These boats will be sold at low values in comparison with their original cost of from $75,000 to 80,000 each. Apparently the best commercial use to which these vessels can be put is in the fishing industry. The suggestion has been made that purchasers remove two of the engines, using the space now occupied by them, the officers' quarters and the forward magazine for a midshiphold, which would be approximately 30 feet long. Plans have also been discussed for converting them into fire boats and many yachtsmen have been interested in the vessels.

There will be 117 submarine chasers offered for sale at the Bureau of Supplies and Accounts, Navy Department, Washington, February 2, 1920. The terms of sale have been modified for this sale, calling for a cash deposit of only $25.00, which, if accepted, will give the successful bidder

45 days to complete payment and remove the boat. Of the submarine chasers to be put up for sale there are approximately 54 in the vicinity of Boston, 29 at Brooklyn, 6 at Philadelphia, 5 at Hampton Roads, 11 at Charleston, S. C., 3 at Key West, 2 at New Orleans, 1 at Great Lakes, 4 at Puget Sound, 1 at San Francisco, and 1 at Christobal, C. Z.—*The Nautical Gazette*, Jan. 17, 1920.

PERSONNEL

PROMOTION IN THE NAVY.—*Secretary Asks Age Limit Be Deferred.*—The Secretary of the Navy, in a letter to the Speaker of the House, asks the enactment of a bill that would "defer until June 30, 1921, the age limits for promotion by selection, which under existing law will become effective June 30, 1920." The Secretary thus explains the reasons for the request:

"The naval appropriation act of Aug. 29, 1916, prescribes certain age limits for promotion to the grades of rear admiral, captain and commander, to become effective on June 30, 1920, and any officer becoming ineligible for promotion on account of age shall be placed on the retired list of the navy. By a provision of the act approved July 11, 1919, this restriction upon promotion has been deferred, in the cases of commanders, until June 30, 1921. The department is strongly of the opinion that the same deferment should be made in the cases of the other two grades, for the sake of uniformity and more particularly because, if this is not done, the navy will lose the services of many valuable officers who, rendered ineligible for promotion on June 30, 1920, by reason of age, must therefore be retired. These officers have performed efficient service during the World War and their compulsory retirement, when their services are greatly needed, would be regrettable and not good business administration from the government's point of view.

"The general provisions of the selection law are sufficient to insure that none of these officers will be promoted unless in all respects qualified therefor, as even after selection the officers recommended for promotion must undergo the prescribed mental, moral, professional and physical examinations before they can be promoted. If any of these officers should fail to establish their superior qualifications for promotion in competition with other officers with whom their records must be compared by the selection board, their promotion will not be recommended, but they should not be excluded from promotion by an arbitrary age limit which does not now and has never heretofore obtained, but which will become effective, as above stated, on June 30, 1920, unless existing laws are modified by Congress. The compulsory retirement of such officers upon reaching the age limit for promotion is, particularly at this time, a penalty from which the navy will suffer more seriously than the individual officers so retired, and the operation of this provision might well be postponed by the government for another year."

Effect of Age Limit Retirement.—The legislation requested by the Secretary of the Navy that would defer until June 30, 1921, the provision requiring officers of the navy to retire upon reaching certain age limits, provided they have not been promoted to permanent rank, beyond a doubt would seriously affect the flow of promotion. The present law provides for retirement of a captain fifty-six years old who has not been promoted to rear admiral; of a commander fifty years old not promoted to captain; and of a lieutenant commander forty-five years old not promoted to commander. If the requirements of the present law are carried into effect on June 30, 1920, it will retire twenty-nine officers, among them eight captains now holding the temporary rank of rear admiral, and four permanent captains, four commanders and thirteen lieutenant commanders. In this list of twenty-nine there are many officers whose services are regarded as extremely

valuable to the navy, and the year's extension would consequently allow recommendations to come before one more Board on Selection and give an opportunity for some of them, at least, to make the required higher grade before the operation of the age limit statute.

While the tendency of the secretary's suggestion, if adopted, would be to check the flow of promotion for at least a year, and longer in the grades where officers approaching the age limit may be promoted, it should be borne in mind that if the personnel legislation recommended by Rear Admiral Thomas Washington, chief of the Bureau of Navigation, should be adopted at this session of Congress, it will provide a greater number of promotions in the higher ranks because of the additional number of permanent officers appointed into the navy from the temporary navy and reserve forces. This increase would have a strong tendency to minimize the effect of raising the age limit and the check to the flow of promotions would consequently be neglible.

While this request of the secretary is not wholly acceptable to some progressive officers of the navy, they are disposed to recognize that of the officers approaching the age limits many have failed to go forward in rank for reasons over which they had no control and that it would be a loss to the service were these men ruthlessly cut off, particularly in view of the expansion recommended by the Bureau of Navigation. On the other hand, the sentiments of Admiral Washington regarding the restoration of the "Plucking Board" are taken as a guaranty that the officers who have been passed over by several selection boards because of inefficiency will not be relieved from their melancholy position just because the board on selection has it in its power to grant such relief. Selection is unpopular with at least seventy-five per cent of the officers of the navy and any semblance of promotion through favor would arouse a solid protest from the service.—*Army and Navy Journal*, Jan. 31, 1920.

NEW MARINE CORPS SCHOOL.—The U. S. Marine Corps Institute, for enlisted men of that corps, has started successfully at Quantico, Va., the base and training school for expeditionary duty. It is intended that the new school shall rank high as an educational institution. The school opened on January 5, 1920, with an enrolment of about 200. Before the end of the week more than 400 of the 600 men stationed there were enrolled and in attendance.

At first it was considered doubtful if a facility for such a school as was planned could be formed without engaging civilian instructors, but a canvass of officers and men at Quantico showed men with teaching experience in nearly all branches. The faculty as formed comprises more than thirty, and eighteen courses of study have been mapped out. Work in the academic branches, such as languages, methematics, etc., is arranged so that the entire three hours each day is devoted to classroom work, work in the trade schools, such as automobile mechanics, electrical engineering, etc., are so divided that half the time is spent in class work and half in practical work in the shop.

To make it possible for all those who desire to attend the school, all of the drilling and other regular military training is completed in the forenoon and the entire afternoon is available for school work. All men who enroll in the school are exempt from guard duty, which is performed by men who are listed for discharge in the near future. While enrollment is entirely voluntary, each applicant must undertake fifteen hours of study or practical application each week, arranged in three hours per day for five days.—*Army and Navy Journal*, Jan. 24, 1920.

BONUS FOR NAVY RE-ENLISTMENT WITHIN YEAR.—Largely due to the fact that an increase in pay for the enlisted ratings of the U. S. Navy has not been enacted into law, the majority of the continuous service men have not re-enlisted. While this is due in a measure to the fact that these

men can obtain greater compensation in the merchant marine, it is believed that as these men are satisfied with navy service an opportunity should be open for them to return to the navy through a change in the law so as to give them the benefits of continuous service coupled with an increase of pay when that shall be granted. The Navy Department has suggested to Congress that special inducements be offered the continuous service pay men by the enactment of a law which will provide that "any enlisted man or apprentice seaman who, having been honorably discharged from the navy service, shall re-enlist within one year thereafter shall, on presenting his honorable discharge or on accounting in a satisfactory manner for its loss, be entitled to a gratuity of four months' pay equal in amount to that which he would have received if he had been employed in actual service during the four months immediately following his honorable discharge from the navy service, and shall receive all the benefits of continuous service." In effect this means that a man would continue in his regular rating as though he had "shipped over" on the expiration of enlistment, and receive the four months' pay gratuity providing he re-entered the navy within a year after taking his honorable discharge.—*Army and Navy Journal*, Jan. 24, 1920.

NAVY PERSONNEL HEARINGS.—Admiral Robert E. Coontz, Chief of Naval Operations, and Rear Admiral Thomas Washington, Chief of the Bureau of Navigation, were heard on the question of navy personnel by a subcommittee of the House Committee on Naval Affairs on January 15. The admirals were questioned on practically every detail connected with the service, including the fleets, training stations, and the number of men and officers on duty at sea and on shore. Two public sessions were held, morning and afternoon, the second being made an executive session shortly after it began for the reason that the committee desired to question the admiral on matters concerning our relations with foreign powers. Admiral Coontz stated that the navy proposes to carry 9880 officers and 170,000 enlisted men. This number will include 143,000 Regulars and 27,000 Reserves in training. Admiral Coontz stated there were now 262,000 Reserves. The enlisted personnel would be allotted at 91,000 for sea and 79,000 for shore duty, according to the present plans. Admiral Coontz said that the navy now numbers approximately 101,000 men, which number shows a shortage of 65,000 to man the ships and stations. "Unless the Navy Pay Increase bill is passed I believe this number will dwindle further. In that case I see only universal service for our youth. Our ships would be manned then," he said.

As to his views on the number of men to a ship Admiral Coontz stated that he believed in a fully manned ship and because the personnel was constantly changing our navy required more men than those of foreign services where the countries hold men in the service. Admiral Coontz said that the two big fleets, the Atlantic and Pacific, will meet in the Atlantic waters in September provided there are men to man the ships. The hearing turned to conditions on the Pacific coast. "When we get all our ships out on the Pacific there will be 186 ships of all classes," said Admiral Coontz, "but in the future we contemplate having approximately 250 ships there." The hearing developed that present plans call for the establishment of a docking and repair plant at San Francisco Bay to cost $10,000,000. The Secretary of Navy, it was stated, was disposed to accept from the city of San Diego, Calif., free from incumbrances and without cost to the United States, a tract of land containing 127 acres for use as a site for a navy repair station, being land now leased to the U. S. Shipping Board, Emergency Fleet Corporation; and also a tract of land in San Diego, together with the land lying between this property and the waters of the harbor, for use as storage purposes; and another tract of land being the submerged land along the shore line of San Diego Bay extending from the north line of the naval training station site to the south line of the quaran-

tine station, for use in connection with the new naval training station which it is proposed to establish at a cost of $1,000,000. The improvement of the U. S. Naval Station, Pearl Harbor, Hawaii, to cost $1,407,000, and $80,000 for the Naval Ammunition Depot at Pearl Harbor, was also discussed. An appropriation of $1,019,000 for the marine barracks at San Diego, and another of $200,000 for the navy fuel depot, in the same city, with the intention to complete the marine railway, were urged on the committee. Toward the development of a submarine base at San Pedro, Calif., the Secretary of Navy has asked for authority to accept from the city of Los Angeles, Calif., free, a tract of land in the harbor of Los Angeles containing 223 acres, the work to cost approximately $1,500,000. Admiral Coontz asked for favorable action also toward the development of a submarine and destroyer base at Port Angeles, Wash., to cost approximately $1,000,000, and another submarine and destroyer base at the mouth of the Columbia River. For this contemplated work the city of Astoria, Ore., is willing to give free a tract of land at Tongue Point, Columbia River, containing 115 acres. The base would cost about $1,000,000.

Mr. Kelley questioned Admiral Coontz regarding the feasibility of establishing an extensive base at San Diego omitting the plans for San Pedro, to which the Admiral replied that from San Pedro submarines would be able to submerge and go out to sea on a straight course. This would not be true at San Diego, where a circuitous route, by reason of geographical features, would have to be followed by the submarines.

Increasing Officer Personnel.—Concerning the matter of increasing the officer personnel of the navy Admiral Coontz stated that he believed the men could be obtained from Reservists and temporary officers. "I favor filling 1200 vacancies from this number in the future, provided they pass the requirements," he added. "The grade from senior lieutenant down would be open for them." Mr. Butler asked if it would not be the policy to give the first opportunity to the enlisted men in the service for the officer grade. "I believe in that policy and advocate it," said the Admiral.

The following figures of officer personnel were submitted to the subcommittee: 6800 line officers; 1393 medical; 214 dentists; 618 supply officers; 171 chaplains; 10 professors of mathematics; 340 construction corps; 136 civil engineers. On January 1 the navy numbered 101,000 enlisted men and 7845 officers, Admiral Coontz stated.—*Army and Navy Journal*, Jan. 17, 1920.

MERCHANT MARINE

AMERICAN SHIPPING NOW TOTALS 15,441,876 GROSS TONS.—The total registered enrolled and licensed American shipping on January 1, 1920, according to the records of the Bureau of Navigation, Commerce Department, was, in round numbers, 28,500 vessels of 15,325,000 gross tons. The complete returns not all received yet of smaller vessels from various seaports probably will not change the total 50,000 tons. The complete returns for the first quarter ended September 30, 1919, of the current fiscal year show the following distribution of tonnage registered for the foreign trade and enrolled or licensed (small vessels) for domestic trade:

	June 30, 1919		September 30, 1919	
	Number	Gross tons	Number	Gross tons
Registered	5,032	6,669,726	5,347	7,860,070
Enrolled	12,646	6,108,811	12,752	6,178,998
Licensed	9,835	128,763	10,023	135,520
Total merchant marine	27,513	12,907,300	28,122	14,174,588

During the following three months ended December 31, 1919, the seagoing ships of 1000 gross tons or over increased 250 of 1,101,692 gross tons. Seagoing ships of 1000 gross tons or over on January 1, 1920, num-

bered 2584 of 9,588,787 gross tons, of which the United States Government, represented by the Shipping Board, owned 1465 of 5,940,742 gross tons, or 62 per cent of the tonnage. A year ago on January 1, 1919, our documented seagoing ships of 1000 gross tons or over numbered 1663 of 5,656,856 gross tons, of which the government, represented by the Shipping Board, owned 608 of 2,303,015 gross tons, or 41 per cent of the total tonnage.

During the calendar year 1919 our registered enrolled and licensed tonnage increased from 11,261,444 gross tons to 15,325,000 gross tons, of which increase nearly all, 3,931,930 gross tons was of seagoing ships of 1000 gross tons or over and of this increase 3,637,777 gross tons are owned by the Shipping Board and built with appropriations by Congress. Up to June 30, 1919, the expenditures of the Construction Division of the Shipping Board aggregated $2,512,692,000, of which $1,741,997,945 were expended during the fiscal year ended June 30, 1919. For purposes of comparison the value of the exports of the United States carried in American ships (including the Great Lakes) during the year ended June 30 1919, was $1,617,234,923 and for the two years ended June 30, 1919, was $2,594,953,852.—*The Nautical Gazette*, Jan. 24, 1920.

PANAMA CANAL'S RECORD TRAFFIC.—Traffic through the Panama Canal in 1919 exceeded that of any previous year. Two thousand, three hundred and ninety-six commercial ships of 7,128,000 net tons, in addition to naval ships, passed through the waterway. The cargoes of the merchant ships amounted to 7,711,000 tons.

Ships measuring 7000 tons, carrying 10,000 tons of cargo, constituted 2 per cent more of the total tonnage than in any previous year.

December broke the monthly record, as 283 ships of 957,000 net tons, carrying cargoes of 953,000 tons, traversed the canal. The tolls collected amounted to $891,378 for December and $6,972,000 for the year.—*The Nautical Gazette*, Jan. 10, 1920.

DETAINED EX-GERMAN LINERS FINALLY RELEASED.—Through the action of President Wilson, the seven ex-German transports which have lain for several months in New York harbor and which were delivered to the Allies by Germany at the close of the war, have finally been turned over to British interests. The vessels, with their tonnage, are as follows:

Vessel	Gross Tonnage
Graf Waldersee	13,193
Zeppelin	14,167
Pretoria	13,234
Cap Finisterre	14,503
Mobile	16,960
Prinz Friedrich Wilhelm	17,028
Kaiserin Auguste Victoria	24,581
	113,666

The status of this tonnage has been a matter of diplomatic dispute. After the armistice, the ships were allocated by the Interallied Maritime Council to this country for use as transports. Later, Great Britain contended that she was entitled to the craft on the theory that the food exchange basis upon which they were allocated was not still in force. The *Imperator*, in the same category with the others mentioned, has already been turned over to Great Britain and is now sailing under the Cunard flag.

Delay in the turning over of the ships to Great Britain is generally held to have been directly connected with the status of 12 tankers of the German subsidiary of the Standard Oil Company of New Jersey. These tankers were interned in German harbors when hostilities began. Some

months ago, the Interallied Maritime Council allocated them to Great Britain, France, Belgium, and Italy, and they were taken to the Firth of Forth. Since then the Standard Oil Company has requested the State Department frequently to obtain the return of the tankers. The Supreme Council in Paris lately ordered that they should be held by the British until their final disposition had been decided.—*The Nautical Gazette*, Jan. 10, 1920.

THE SALE OF EX-GERMAN LINERS.—Cost of reconditioning former German passenger vessels was the chief factor entering into the decision of the Shipping Board to put them on sale, Chairman John Barton Payne said upon his return from a holiday visit in North Carolina.

"It developed that it is going to cost the Shipping Board about $50,000,000 to recondition these ships so that they can be used for passenger service after their use as transports. It will cost $500,000 just to wire the *Leviathan*.

"Commissioner Scott suggested that in view of this situation we make a drive for the sale of the ships. If we fail to sell them we will operate them ourselves. In making any sales we shall stipulate that the vessels must be retained in certain services, such as South American and trans-Atlantic routes, to which we have assigned them."

The board received bids on the former German vessels up to January 20. If satisfactory bids are not received it will continue its original plans to recondition the ships.—*Shipping*, Jan. 28, 1920.

NAVIGATION AND RADIO

"DEAD RECKONING."—What is the origin of the nautical term "dead reckoning"? Perhaps the general impression is that the prefix "dead" is so common in technical terms related to the ship and its rigging that it is merely the mariner's way of expressing himself. There are "dead-eyes," "dead-lights," "dead-wood," "dead-door," "dead-flat," and a host of others, and all savor more of the ozone than of etymological necessity. But there is a peculiar interest in the origin of "dead reckoning," which has always been regarded as one of the most puzzling terms to trace, according to Henry Harries of the British Meteorological Office, whose explanation appeared in *The Morning Post* of London. Mr. Harries states that the old-fashioned method of keeping the ship's log, before the admiralty supplied specially printed books, was to use small, loose sheets of paper, ruled into several columns. The latitude column being too narrow to admit the words "deduced latitude" in full at the head, the words were abbreviated to "Ded. Lat." "Ded." easily became corrupted into "dead," and hence the singular phrase for describing the mariner's "deduced" position on the high seas.—*The Christian Science Monitor*, Jan. 30, 1920.

THE VACUUM TUBE—AN ELECTRICAL ACROBAT.—*What It Is: What It Does: Who Uses It and How: What It May Do in the Future.*—Speaking from an electrical point of view, and if the use of such a simile may be pardoned, the vacuum tube is rapidly on its way to become the Aladdin Lamp of the future. In a few short years it has emerged from the experimental stage to a very potential and formidable wonder-machine, capable of performing more practical electrical feats than any other given instrument. For this reason the scientific world in general should know a few facts concerning its origin, how it functions, what uses are being made of it to-day, and what it is likely to accomplish in the future.

Historical.—The vacuum tube in its present form cannot be accredited to any one individual, but is the result of the combined efforts of several radio investigators. It is known and referred to under many names, in several cases the name being closely allied to the purpose for which it is

employed, as well as to the researches of individual investigators, such as the Fleming Valve, the Audion (de Forest), the Electron Relay, the Oscillon (de Forest), the Pliotron (General Electric), the V.T. 1 and 2 (Western Electric), the Kenotron, the Dynatron, etc. Of late, however, the name vacuum tube, abbreviated to "V.T." is the more popular term.

In its various forms and applications, the V.T. depends upon the phenomenon of thermionic emission of electrons for its operation; and although Mr. Edison is credited with the discovery of the following effect which bears his name—the Edison Effect—Dr. J. A. Fleming of England was probably the first scientist to make use of the fact that the space immediately surrounding the heated filament of an ordinary electric light bulb is capable of conducting a minute electric current in one direction only, such as a direct current, providing that an insulated medium called the "plate" be inserted in close proximity to the heated filament, and that this plate be supplied with a positive potential. For this reason his invention was named the Fleming Valve. This discovery was immediately made use of in the reception of radio telegraph signals, for in those days considerable difficulty was experienced in providing a suitable rectifier or detector for the received high-frequency oscillations. This so-called two-element valve, however, did not prove very satisfactory as a radio detector.

Dr. Lee DeForest, a pioneer investigator and inventor of radio apparatus, greatly improved the aforementioned arrangement by inserting a third element known as the "grid" directly in the space separating the heated filament and the plate.

This improvement and the signal results obtained by the addition of the grid immediately started many investigators at work to discover the most effective size and spacing of three elements, as well as to secure as near a perfect vacuum as possible; so that to-day, in addition to being a most effective detector and amplifier of radio signals, the vacuum tube can also be made to generate high-frequency currents now extensively employed in both radio telegraphy and telephony.

The V.T. as a Detector.—Probably the most general and important use of the V.T. to-day is as a detector of radio signals. In this capacity it is quite an improvement over Marconi's magnetic detector as well as the many forms of crystal receivers which, for want of something better, have been in general radio use since the exit of the coherer. Not only is the V.T. an extremely sensitive detector, but by simply changing its circuit connections it can be made to amplify the received signals as well. The great fault with crystal detectors, or rectifiers as they are sometimes called, is their unstable operation; that is to say, it is necessary for an operator to find the most sensitive spot of the crystal by carefully adjusting the point of contact, and this can only be ascertained when signals are being received, or by using an artificial source of oscillations. Even after the proper adjustment has been obtained, the least vibration or movement of the crystal will render the detector inoperative. The same applies to an unusually heavy "stray" or "static" disturbance. The vacuum tube eliminates all this. The operator simply turns a switch controlling the heating of the filament, and the detector is immediately in condition to receive, rectify and amplify at maximum sensitiveness.

There are two forms of oscillations used in radio signalling—damped and undamped waves. The older and more generally used damped wave form is employed by ships and shore stations for local work, while the undamped wave form is the one employed in long distance, trans-oceanic radio telegraphy and telephony work. With the V.T. it is possible to receive either form of wave by proper circuit connection, while the crystal and other forms of detectors are capable of rectifying damped waves only. There are, of course, other forms of detectors which may receive undamped waves, but the V.T. is the only instrument which receives both wave forms efficiently.

The first of the accompanying illustrations, Fig. 1, shows a typical V.T. of the receiving class, and of a type which has been used extensively by the army and navy, during the war. As will be noted, it consists of a bulb not unlike an ordinary electric light, provided with a specially-constructed base from which protrude four contacts, two of which are for the filament heating-current supply, one for the plate and the other for the grid connections. The inside of the bulb, which is subjected to a high vacuum, contains a tungsten or oxide filament of long service life; two metal plates and two metal grids, the latter arranged between the plates

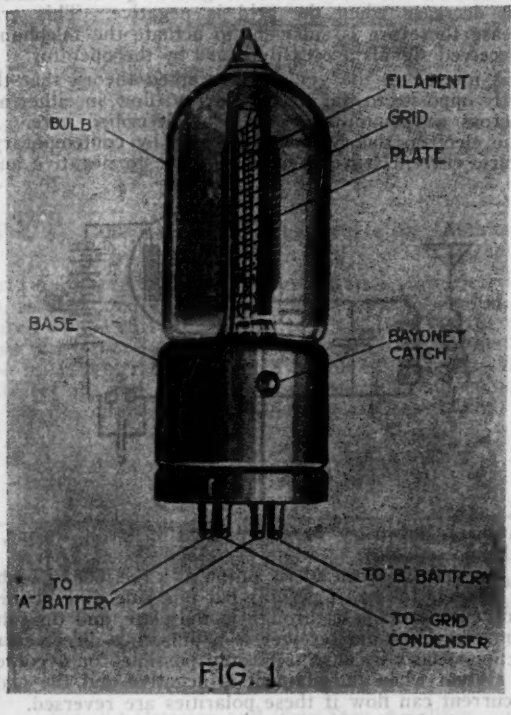

FIG. 1

and filament. The bulb is designed to fit a four-contact receptacle of the bayonet type not shown in this illustration.

Fig. 2 shows one method of connecting the vacuum tube as a detector or rectifier of high frequency oscillations used in radio signalling. The theory of its action as such may be briefly explained as follows:

As soon as the filament *F* is heated to incandescence by the three storage cells comprising what is commonly known as the "*A*" battery, and the intensity of the current is properly regulated by the rheostat *R*, there are emitted from the filmament negatively charged electrons which, in turn, are immediately attracted to the plate *P* due to the fact that this element is connected to the positive pole of a series of small dry cells or storage battery cells known as the "*B*" battery, with a potential ranging from 20 to 60 volts. This process of electronic emission continues as long as the filament *F* remains heated. The grid *G*, which

normally lies directly in the path of the electrons, is connected to the aerial *A* or other external source of incoming oscillations through the grid condenser *GC* and the receiving transformer inductances *P* and *S*. These radio frequency oscillations impress themselves on the grid in constantly changing directions; that is, one instant the grid potential is positive and the next instant it is negative. When the grid is negative the stream of electrons flowing to the plate is slightly retarded, causing a slight decrease of plate current; but when the grid is positive there is an immediate additional flow of electrons towards the plate which has the effect of greatly increasing the plate current. In general there is a greater plate current increase when the grid is positive than there is a plate current decrease when the grid is negative. This greater plate current increase therefore is sufficient to actuate the telephone receivers *T*, and the received signals are easily heard by the operator.

Attention is invited to the generally accepted theory that the electron flow is directly opposite to the electric current flow in either a solid conductor or across a vacuum space such as described here. Before the advent of the electron theory it was decided by contemporary scientists that the electric current traveled from positive to negative and although

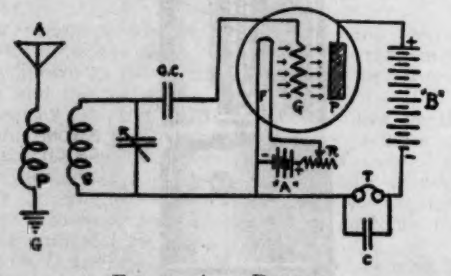

FIG. 2.—As a Detector.

this explanation is arbitrary to the present electron theory, it is still retained at the present day.

In a sense the V.T. by virtue of its action, is a rectifier of high-frequency oscillations. That is to say, it permits but one side (the positive one) of the alternating current to pass through to the plate, and thus the resulting impression on the telephone receiver is a pulsating direct current. This rectifying action occurs because it is only possible for a current to flow through the system when the filament is negative and the plate positive, whereas no current can flow if these polarities are reversed.

Amplification of signals.—In the old days of the coherer and crystal detectors, the establishment of long-distance records or the bridging of great distances by means of radio telegraphy or telephony depended primarily on the use of excessive power at the transmitting end, for reception was confined to but one detector; that is, once the signal was received, no matter how weak it was, there was no means of amplifying it, and very often this signal strength was not sufficiently strong to be properly intercepted by the operator. The entry of the V. T. completely reversed this condition, first, by proving itself to be much more sensitive to the detection and rectification of electromagnetic waves than other forms of detectors, and secondly, after having detected the incoming signal, being also capable of amplifying it for reception by the use of one or more stages of amplification. The result of all this is that on the average it is no longer necessary to employ excessive power to bridge the same distances; or, allowing the use of maximum transmitting power,

it is now possible to cover approximately twice the distance of former days.

Fig. 3 shows a much used circuit devised by E. H. Armstrong and known as the "Regenerative Circuit." This method makes possible the simultaneous detection and amplification of the incoming signal by the use of a single tube. The explanation for this action is as follows: Consider Fig. 3, in which oscillations are received by antenna *A* and trans-

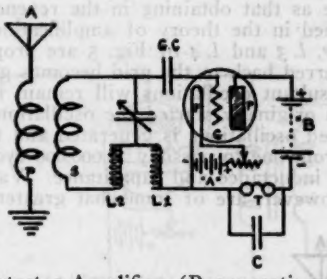

FIG. 3.—Detector-Amplifier (Regenerative Circuits).

ferred to grid *G* by receiving inductances *P* and *S* through grid condenser *G. C.* This, as explained in the action of the detector in Fig. 2, will produce variations of the current supplied to the plate *P* by the plate battery "*B.*" These plate current variations—rise and fall of oscillations—will therefore be re-transferred to the grid circuit by travelling through telephone condenser *C*, and regenerative-transformer inductances *L 1* and *L 2*. This has the effect of amplifying the grid oscillations to such an

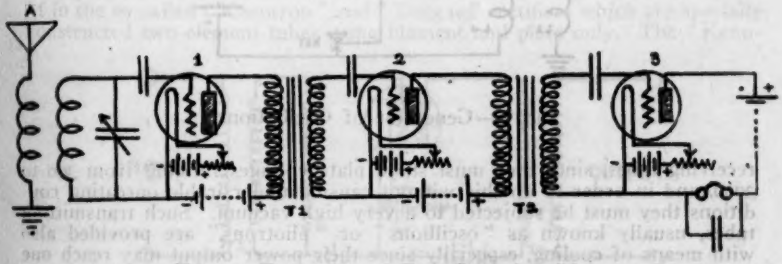

FIG. 4.—Detector and Two-Step Amplifier.

extent that they will in turn increase the rise and fall of the plate current, thereby greatly increasing the resulting sound in telephone receivers *T*.

Fig. 4 shows a radio circuit employing three tubes, number 1 as a detector of oscillations and numbers 2 and 3—through the intermediary of the audio-frequency iron-core transformers *T 1* and *T 2*—as two steps of amplification for the received signals. Two-step amplifiers are now in general use and are considered as giving a receiving amplification of 10,000 times. Additional steps up to ten stages, usually referred to as "cascade" amplification, have been used successfully, but such involved apparatus requires the most careful adjustment by experts.

The radio compass, which has been developed and brought to a high degree of perfection during the war, would hardly be out of the laboratory stage to-day were it not for V. T. amplification. This is largely due to

the fact that the V. T. makes possible the reception and amplification of the extremely feeble oscillations picked up by the small capacity loop antenna.

As a Generator of High Frequency Oscillations.—In addition to being an excellent detector and amplifier of radio signals, the V. T. may also be employed to generate the necessary oscillations for either radio telegraphy or telephony. Fig. 5 shows one method of connection capable of producing high-frequency oscillations. The condition which makes this possible is practically the same as that obtaining in the regenerative circuit, Fig. 3, and already explained in the theory of amplification. That is to say, if inductances *L 1, L 2, L 3* and *L 4* of Fig. 5 are properly coupled and the plate energy transferred back to the grid becomes greater than the initial grid energy, the resultant oscillations will remain in the system even if the condition which originally started the oscillation is eliminated. Thus a series of undamped oscillations is generated and the frequency may be controlled at will from one to possibly 20,000,000 cycles per second by the proper variation of inductance and capacitance. Vacuum tubes employed for this purpose, however, are of somewhat greater dimensions than the

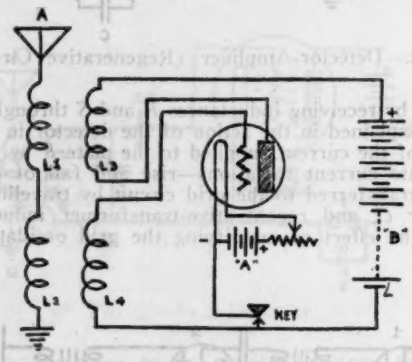

FIG. 5.—Generator of Oscillations.

receiving tubes, since they must stand plate voltages ranging from 300 to 3000, and in order to do this without causing undersirable opreating conditions they must be subjected to a very high vacuum. Such transmitting tubes, usually known as "oscillions" or "pliotrons," are provided also with means of cooling, especially since their power output may reach one kilowatt or more. To secure additional power output, several tubes may be connected in parallel. In fact, there seems small doubt that this form of generating high-frequency oscillations will be used extensively in the future. Fig. 6 shows a simple circuit diagram of a V. T. in connection with a radio telephone transmitter, and is practically self-explanatory.

The V. T. as a Telephone Repeater.—In its manifold applications to radio telegraphy and telephony, very few outside of those immediately concerned are aware that the V. T. plays an important rôle in the businessman's daily telephone conversations from New York to Chicago or Denver or San Francisco. The repeater, as applied to wire telephony, is an instrument placed at various intervals in long-distance telephone line, and is designed to reinforce telephonic currents which have become enfeebled in travelling through long stretches of wire. In this connection the vacuum tube is employed to repeat and amplify the telephone current fluctuations produced by the voice, and performs this in a manner similar

to the amplification of radio oscillations. Not only this but by the use of vacuum tubes and special filter devices, multiplex telephony and telegraphy becomes a reality, where five or more telephone conversations in addition to a Morse telegraph line are superimposed on one circuit.

Fig. 7 shows a schematic diagram of the method in which the V. T. may be connected as a telephone repeater and amplifier. In this circuit *T 1* is a step-up transformer, which transfers the incoming telephone current

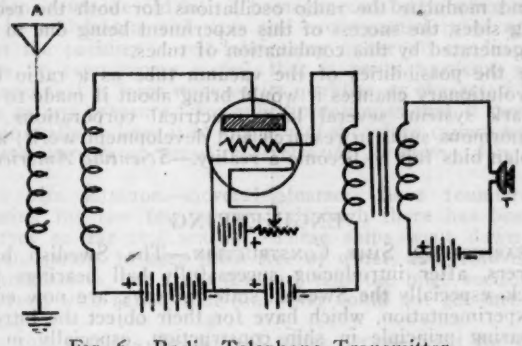

FIG. 6.—Radio Telephone Transmitter.

to the grid, *R* is a high resistance, *C* is a battery designed to make the grid negative, and *T 2* is a repealing coil which impresses the plate circuit variations on the telephone line.

Rectifier of A. C. to D. C.—The fact that the V. T. has the property of rectifying A. C. to D. C. as explained in its action as a detector, is made use of in the so-called "Kenotron" and "Tungar" rectifiers which are specially constructed two-element tubes using filament and plate only. The "Keno-

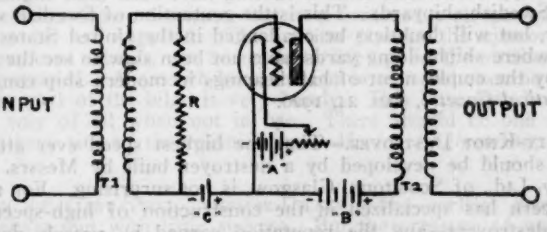

FIG. 7.—As a Telephone Repeater.

tron" is employed for changing alternating currents of high voltage and low frequency to pulsating direct currents, while the "Tungar" rectifier is used commercially to rectify 120-volt alternating current to direct current of low voltage and amperage suitable for the charging of automobile storage batteries.

Future of the V. T.—The vacuum tube, in modified forms suitable for each individual requirement, will shortly play an important rôle in the electrical and radio fields. It is capable of performing many feats, a fact which suggests a wide range of future activities for this invention. At present it is particularly successful as applied to the art of communication, and the day is not far off when telephone, radio telegraph and cable distances will be doubled and trebled, to say nothing of other inventions

which have not yet been fully developed and commercialized, such as transmission of photographs by wire, long-distance radio telephony, high speed cables and others.

A remarkable long-distance radiophone conversation, which is prophetic of future development, took place in 1915 between Washington, D. C., and Honolulu, or over a space of approximately 5400 miles. In this feat, which has never been equalled since, and the exact details of which remain a government secret, a battery of 310 vacuum tubes was employed to generate and modulate the radio oscillations for both the receiving and transmitting sides, the success of this experiment being due to the perfect frequency generated by this combination of tubes.

Realizing the possibilities of the vacuum tube as a radio transmitter, and the revolutionary changes it would bring about if made to replace the present spark system, several large electrical corporations are to-day spending enormous sums in research and development work; and what is more the plan bids fair to become a reality.—*Scientific American*, Jan. 17, 1920.

ENGINEERING

BALL BEARINGS IN SHIP CONSTRUCTION.—The Swedish ball bearing manufacturers, after introducing successfully ball bearings in Swedish rolling stock, especially the Swedish state railways, are now entering new fields of experimentation, which have for their object the introduction of the ball-bearing principle in ship construction, especially in connection with propeller shafting. The problem involves the construction of a bearing able to withstand all axial pressure from the propeller and excluding all possibilities of hot box and kindred troubles. The successful ball bearing must under the most trying conditions be able to withstand the axial pressure automatically and must require little or no attention. It must be of such simple and reliable construction so that friction within the same is minimal and the ship's movements not influenced disadvantageously by the ball-bearing mechanism.

While ball bearings are used to a considerable extent in marine engineering, their application and their mounting have seen their highest development in Swedish shipyards. This is the contention of Swedish shipbuilders generally, but will doubtless be challenged in the United States and Great Britain, where shipbuilding yards have not been slow to see the advantages offered by the employment of ball bearings in modern ship construction.—*The Nautical Gazette*, Jan. 24, 1920.

A FORTY-KNOT DESTROYER.—That the highest speed ever attained by a warship should be developed by a destroyer built by Messrs. Yarrow & Company, Ltd., of Scotstoun, Glasgow, is not surprising. For many years this concern has specialized in the construction of high-speed vessels—notably destroyers—and the reputation earned by vessels designed and built at this plant has been an enviable one. Such results have been made possible, however, only by the extensive experimental and research work carried out by this firm, and their latest achievement is a fitting reward for years of painstaking effort. The vessel which has set a new world's record for high speed is the destroyer *Tyrian*, of 1060 tons displacement, which on December 16 obtained a speed of over 45 miles an hour, or better than 40 knots, on an admiralty four-hour official trial in deep water. Had the vessel been run in shallow water, a considerably higher speed would undoubtedly have been obtained, so that the performance is all the more remarkable. The *Tyrian* has a length of 273 feet and is fitted with turbine machinery supplied with superheated steam by the latest type of oil-burning Yarrow watertube boilers.—*Marine Engineering*, January, 1920.

A NEW METAL PACKING.—An interesting material, which may perhaps best be described as metal fiber, is on the market for use as a packing in all joints, etc., which are under pressure. The substance is 90 per cent metal, while in structure it seems to be partly shreds somewhat similar to asbestos, and partly an impalpable powder. It cakes under pressure in such way as to hold a shape, but never becomes too hard to be broken and crumbled by the fingers. It is described by the makers as "a plastic metallic composition that is easily compressible." Any fresh material will readily combine with the old into a homogeneous body, while the packing can always be withdrawn with ease and every particle used again. It is claimed that the packing is self-lubricating under all conditions, that it never scores or even tapers a rod, that it never hardens, perishes or crystallizes and that it loses none of its qualities or characteristics at any temperature or any pressure. Its only limitation is that it requires some pressure continually to keep it in shape, and therefore cannot be used as a packing where there is no pressure.—*Scientific American*, Jan. 9, 1920.

VALUE OF THE EJECTOR.—Several steamers have foundered in the Atlantic during the last few months, although there has been no very severe weather so far this season. These ships went down from the inability of the pumps to keep them free of water, and from no cause of the pumps themselves, but from the fact that the bilge suction strainers were so covered with refuse that the water could not get through to the suction pipes.

Whenever this happens the normal water service used for cooling the working parts of engines, together with the usual leaks in the engine room, quickly raise the water in the bilge to such a height that a man has to dive down to the strainer box to clean it.

In a heavy seaway that is a dangerous thing to do, for in many ships the bilge suctions are placed in a section between two tanks with only a manhole through which to reach the strainer. If the man is swept away he is like one who has fallen through a hole in the ice—"up against it."

In such an emergency there is one thing, however, that an engineer will turn to if he has it on the ship, and that is the ejector, or siphon, as it is called.

This instrument blows the water out in a continuous stream as long as steam and water are supplied. The suction pipe to the ejector, by the use of a couple of elbows, can be made to lift up, so the strainer on the end can be cleaned. A smooth-bore suction hose which can be dropped down in any part of the bilge is very handy. This hose may be kept up out of the way of oil when not in use. There should be one of these siphons on each side of the engine room.—*Marine Engineering*, January, 1920.

EVOLUTION OF CAST-STEEL ANCHOR-CHAIN.—The earliest attempts to make cast chain met with little success. But the pressure of war conditions in 1917 compelled more earnest attention to the problem. At first electric-furnace steel was used, and the die-casting process, with metal moulds, adopted. The product was sound and of good finish, but it was found impracticable to develop the process for commercial production. Later, a considerable quantity of chain was made, using sand-moulds and cores. Applying heat treatment, and guided by microscopic investigation, the makers produced links of from 60 to 100 per cent greater strength than the wrought-iron links in common use. Thus the General Electric Company felt it had offered a good solution of the problem of producing a cast chain stronger than the wrought-iron chain, and equally tough.

At this point, the National Malleable Castings Company took up the task, and carried it to completion. Instead of following precedent in imitating wrought iron, the company adopted a superior metal, known as

"Maco" steel, and directed its attention to what was the real difficulty, namely, the developing of a suitable foundry method of producing chain links in sand moulds, and uniting them into continuous lengths of chain. Research and experiment resulted in several successful designs of moulds. The next step was to connect the links into chain. This was accomplished in two ways, both of which have proved entirely satisfactory. One is the continuous process, in which the entire chain is poured from one heat into prepared and united moulds by filling one interlinked mould after another. The other is the pre-cast link process, in which half the links comprising a complete length of chain are cast separately, shaken out, cleaned, inspected, and made ready for incorporation into finished chain. These links are then placed in mould cavities and coupled up into continuous chain by pouring metal into other moulds containing impressions for similar links interlinked with those pre-cast. To ensure sound castings, all links are formed in dry sand moulds. When cast, the links are subjected to heat treatment by placing them on a traveller and passing them slowly through a furnace in which the heat is automatically controlled by special contracting pyrometers. At the discharge end of the furnace the links are dropped into a quenching tank of water, and are thence passed slowly, on a second traveller, through a drawing furnace.—*The Institution of Civil Engineers,* October, 1919.

A NEW SUBMERSIBLE SALVAGE PUMP.—There are few problems relative to pumping apparatus for ships' use that have received greater attention during the war than that of the possibility of keeping a ship afloat after she has been badly holed by mine or torpedo. It is obvious that if a compartment is badly damaged, no pumping apparatus would keep the water out. It is, however, quite within range of possibility that the compartments adjacent to those damaged may be kept free from water, provided apparatus is ready for instant use in such an emergency. On several occasions when a ship was mined or torpedoed near shore she could have been beached had it been possible to keep the water out of only slightly-damaged compartments for a few hours. A pump which has been specially designed to meet the conditions indicated above is the Merryweather electrically-driven submersible pump, with which a number of the White Star Line's ships have recently been equipped. The pump can be operated direct from the ordinary ship lighting set or from the emergency lighting set, where such is available, and can be used either totally submerged or above the water-level, the electric motor being carried in an hermetically sealed steel cylinder. A special feature of the apparatus is an intercepting chamber designed to prevent any possibility of water from the pump chambers finding access to the electric motor. A continuous working test of 48 hours' duration, with the pump completely submerged, failed to show the slightest leakage of water into the motor cylinder.—*Engineering and Industrial Management,* Jan. 8, 1920.

MARINE ENGINEERING IN 1919.—The secrecy about shipping matters imposed by the war entailed the omission of our usual annual review of the situation in this branch of engineering. We are not at all sure that even now, nearly 14 months after the armistice, affairs are sufficiently normal to enable us to give a satisfactory survey of the position. For one thing, there have been months of uncertainty on the part of firms engaged in the construction of war vessels of all types—and this means nearly all firms—which precluded them from taking their fair share of commercial work, and the period which has elapsed since the naval authorities definitely decided which ships should be scrapped and which should be completed, has not been long enough to permit of the full development of their commercial activities. Another factor which caused a diversion from the true normal trend of design was the large volume of "Standard" tonnage which had to be completed, as these ships were designed to meet special

conditions imposed by the war, of which rapid construction was the chief. This, of course, necessitated the use of only well-tried mechanical appliances, and therefore must have tended to the postponement of the trial of some inventions, though, on the other hand, it accelerated the adoption of others to an extent which could only have come about by years of ordinary peace-time progress.

We are inclined to think that the Diesel engine is one of the sufferers in this direction. Before the war the geared turbine had just reached such a stage of recognized reliability and economy that it could, without jeopardizing the safety of the country, be installed in cargo ships on a very large scale, and thereby established a very formidable lead over its internal combustion rival in the graces of the shipowner. It will now undoubtedly be very much more difficult for the Diesel engine to overtake this lead than it would have been for it to find its true position in the mercantile marine if the two had been left to fight it out between themselves under ordinary conditions. Undoubtedly, too, the geared turbine can claim to possess many of the advantages of the Diesel, but which really is the best from all points of view—first, cost, space occupied, reliability, economy in running, maintenance and wages—we will not attempt to argue here. We believe, however, that the present form of double reduction gearing is not the last word on the matter, for it does seem to the mechanical mind bad engineering to introduce purely as a subsidiary device a piece of apparatus which is larger than the machine to which it is an auxiliary. None the less, we must admit that the reduction gear is to-day serving a very useful purpose. The extended use of oil firing in conjunction with the geared turbine tends to simplify things down below to an extent which could never have been foreseen by the marine engineer of 20 years ago. Not only can a very much smaller number of hands be carried, but the hard labor is done away with, and little more than supervision and attendance to gauges and telegraphs is called for. Even in the arrangement of the auxiliaries this idea of simplicity is carried to a wonderful pitch. In the United States Shipping Board S. S. *Invincible*, of 11,000 tons, with geared turbines of 3000 shaft horsepower, the pumps are all arranged in a row in one of the wings, all being of the same type and parallel with each other, running from large to small, and making quite a picture. There seems to be no reason why some such straightforward and simple arrangement should not always be aimed at in ships of this type, where the main engines occupy so small a part of the breadth of the ship.

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Samuel White and others have commercial type engines well under way. The two first-named will be of special interest as being of quite novel type so far as commercial use is concerned. We heard during the past year a good deal about the theoretical efficiency of the Still engine and its beautiful maneuvering capabilities, due to the use of steam, and we hope the new year will produce further information in regard to its mechanical details and commercial possibilities, as trials on a practical scale on shipboard have been in progress for some time. In view of the appalling price of bunker coal and the sympathetically high price of fuel oil, the question of economy will become one of more pressing urgency than ever before, so that we may rest assured that any suggestions which hold out the least hope of any saving will receive all the attention they deserve.

Among the minor mechanical details which have been introduced aboard ship and which may now be mentioned is the Michell thrust and journal bearing, which we have already described. This device, we believe it is fair to say, renders possible the installation of the huge horsepowers on a single shaft, which have given our warships their wonderful speeds, and as a "trouble saver" in ships of reasonable speed and power we believe it will have a great future.

With regard to the question of shipbuilding, the year was abnormal. The large tonnage of "Standard" ships prevented the natural development of type, while the vast amount of reconditioning of ships which were in the service of the Admiralty during the war delayed still more a return to normal activities. The tendency towards an increase in size of ordinary cargo ships is no artificial one, and we should regard the 5000-6000-ton ship as the size for which there is the greatest demand to-day. Bigger ships are, of course, being built up to pre-war sizes, but as they take long to build, it happens that the biggest ship launched during the year is of only 18,000 tons—the Castle liner, *Arundel Castle*. It is interesting to note that she will have a cruiser stern, as adopted for many of the war-built cargo ships, simplicity and cheapness of construction having, no doubt, influenced the designers, though Mr. P. A. Hillhouse, who in his paper read before the Institution of Engineers and Shipbuilders in Scotland in November deals very completely with the subject, makes claims for very great savings in horsepower and so in fuel economy.

Though a concrete ship of 7500 tons was launched during the year in America, we believe we may say with justice that there is some indication that the days of the concrete ship, omitting perhaps barges and suchlike craft, are numbered. Shortage of steel during the war gave it its real claim to recognition, but first cost must now receive a reasonable measure of consideration.—*The Engineer*, Jan. 2, 1920.

A METHOD OF CHECKING THE ALIGNMENT OF DIESEL-ENGINE SHAFTS.—It being generally conceded that the alignment of an engine, and especially of the shaft, is a most important factor in satisfactory operation, a simple method of checking this alignment is desirable. This checking should be applied from time to time after the engine is operating and therefore the method proposed should be easily applied without dismantling the engine.

The crankshaft, formed as it is with large intermittent gaps, is a comparatively weak structure, and great care must be used not to strain it in handling during erection. After making sure that the bearing shells are accurately bedded, the shaft should be tested in its bearings for concentricity and roundness of its journals. After any errors are found and corrected, the gaps may be put on and the shaft is ready for operation. This is, of course, the proper method when the engine is being erected.

When the engine has been running for some time and an overhaul is being considered, questions to ask with regard to the crankshaft are: Is it being properly supported in its bearing? Are the bearings in a satisfactory condition? Are all the bearings, including the outboard bearings, in alignment with one another?

The first indication that the shaft is not being properly supported is excessive end play on the shaft with the flywheel running out of true. Since this end play often exceeds the thrust-collar clearance, it must be due to springing of the crankshaft for want of support, thus extending and contracting the shaft by opening and closing the gap between the crank webs. Quite interesting results were obtained by measuring this gap when the given crank was on the top and then on the bottom center. If the bearing next the crank was low, the crank webs would close when the pin was on the bottom center and open when it was on the top center. If the outboard bearing was low, the weight of the flywheel would give the opposite effect. It can be determined from such measurements which bearing or bearings are low and approximately how much since in general the amount will be nearly equal to the difference in the readings at the top and bottom centers respectively.

The use of an inside micrometer for these measurements was found to require very skilful handling, but a point gage and feelers proved much more satisfactory. It is of course necessary to take repeated measurements from between the same points. This can be accomplished by making a slight indentation in the crack web to locate the point of the gage.

The question arose as to how much more the crankshaft would be distorted under operating pressures than when standing still. It was suggested that the full blast pressure be applied when measuring the crank web with the crank on the top center. This was objected to as dangerous to the man making the measurements.

Some objection was made to depending entirely on gaging between crank webs as a criterion for crankshaft-bearing alignment. It was claimed that this method would not accurately indicate eccentricity of journals. Also a great difference in web measurements is shown when taken with or without the flywheel in position. Further, a bearing seldom wears equally throughout its length. In this case the shaft will rest only on the high end and perhaps show very little change in web distance unless the gaging is done under full working pressure. Another objection was the difficulty of interpreting the readings when made on an intermediate crank, this objection of course having no standing when applied to outer bearings.—*Power*, Nov. 22, 1919.

AERONAUTICS

ENDURANCE OF AIRCRAFT.—Every one who followed with attention the development of aeronautics in its relation to the great war must have realized that the fighting machine of the air, whether it be airship, airplane, or seaplane, has a very brief life. Certainly under no conceivable conditions of peaceful service is, let us say, an airplane, driven with such a ruthless hand and so constantly strained almost to the breaking point. An airplane engine, which, if properly made, and particularly if hand-made, is, in respect to the accuracy of its workmanship, one of the most expert pieces of mechanism that has ever been turned out by the hand of man, has a useful life in a fighting machine of only a limited number of hours. At the end of a very brief span of service it will show sufficient deterioration to render it unreliable and even dangerous for service over the enemy's lines.

But for commercial service it is not necessary, as in war service, to drive the engine to its fullest capacity, and it is constant driving at the highest possible speed that shortens the life both of plane and engine. The commercial plane not only has the advantage that it is driven well below its maximum capacity, but because it is not so imperative to cut down weights to the lowest possible limit both in planes and engines, the commercial plane can be of more rugged construction. Quite *à propos* of this discussion, and serving to show that even a fighting machine may

have a considerable term of life, is the case of a fighting machine from the seat of war, as quoted in *Aeronautics,* which had been in continuous commission, first on the fighting front and then in Holland, for over two years, without expenditure for renewals or repairs. The machine was flown over to Hendon, where it was open to public inspection, and subsequently was employed freely in journeying to various parts of the country.

The life of a dirigible is, of course, very much longer than that of an airplane or seaplane. In the first place, its framing is entirely of metal, which, with proper upkeep, is not subject to deterioration. The canvas covering is, of course, more vulnerable, and in an airship subject to considerable use, its life will be not over twelve months. The breaking up of the fabric is hastened, of course, by the fact that it is merely stretched over the duralumin frame and the action of the wind causes a continual slatting of the canvas, which hastens its breakdown. As to the engines, there is everything in their favor as compared with the airplane engine. The demand for lightness is not so severe, and they can be built therefore of more rugged construction; moreover they are rarely, if ever, run at full power, and, as the dirigible has a multiplicity of engines (from four to six in the larger machines) it is possible in a long voyage to give each engine, in turn, a period of rest for cleaning and repairs. Consequently, the life of a dirigible, should it meet with no disaster and not become obsolete through rapid advancement of the art, should reach to several years.—*Scientific American,* Jan. 17, 1920.

PREDICTS 3-INCH GUNS ON WAR AEROPLANES.—Brig. Gen. William Mitchell, Army Air Service, in an address at Washington, D. C., made the prediction that artillery would soon be mounted on and fired from American aeroplanes. He said: "Many persons believe aeroplanes cannot stand the strain caused by the firing of cannon mounted on them, but I believe the plan is perfectly feasible and that artillery will be effectively utilized on aeroplanes in the next war. Nearly two years ago I saw a French 75-mm. gun mounted on a French aeroplane, and the gun was fired without damaging the plane. I believe 3-inch artillery will be mounted on American aeroplanes in a comparatively short time." General Mitchell also said that a new use in war would be made of parachutes and that men armed with machine guns would be dropped from aeroplanes into enemy territory with demoralizing effect.—*Aerial Age Weekly,* Jan. 12, 1920.

AIRPLANE PARACHUTE DROP SUCCESSFUL.—The Air Service Engineering Laboratory, Dayton, Ohio, recently demonstrated the successful use of parachutes as a means of safe exit from an airplane in full flight, which will eliminate all those dangers which have been a bugaboo to flyers. The parachute drop was made from a DH-9-A plane, Liberty motored, flying over 100 miles per hour at an altitude of only 400 feet. The parachute with a 200-pound loading, opened in one and one-half seconds and reached the ground in twenty seconds with its living load with no oscillations whatever. From time to time it has been demonstrated that successful drops could be made at high altitude but at an altitude of only 400 feet, with a high-powered plane, such as a DH-9-A, it is considered remarkable. The parachute used was a reconstructed Martin flat topped with spread of twenty-seven feet when fully opened.—*Army and Navy Journal,* Jan. 17, 1920.

WHAT THE NAVY WANTED.—Rear Admiral Adair, of the British Navy, speaking in the House of Commons on December 15, said all that they asked for in the navy was that they might manage their own little air business themselves; the naval side of it, which he claimed was distinct, should be part and parcel of the navy itself, and should never be dis-

sociated from it. The deciding factor as to whether there would be a navy in the future, such as was now understood, was that the commerce of the world would always go on in surface ships, for no aerial craft could possibly compete with them economically. And if the Mercantile Marine was to go on, then the fighting marine of the navy would go on too. Some forty years ago the navy was to be knocked out of existence by the Whitehead torpedo, but it had not been yet; and even the submarine had been collared. He was satisfied that the menace of the air would not be long a menace at all. There would remain large fighting ships, fitted with some arrangement which would keep off any bombs that aircraft could drop. He foresaw the day when there would be a craft as big as a destroyer, normally travelling on the sea, but able on occasion to rise on her wings and travel at 150 miles an hour through the air. Who could possibly evolve such craft other than naval constructors, and seeing that nine-tenths of their time would be spent on the sea, who was going to man them except seamen? It was really too ridiculous to leave to an Air Ministry, constituted as at present, the evolution of such craft or the administration of them. It was a maritime matter, and ought to be left to the Admiralty.—*United Service Gazette*, Dec. 25, 1919.

PROGRESS IN AERONAUTICS.—In a previous issue of these notes the development of the aeroplane for land service during the war was dealt with; we now come to the use of aircraft for naval purposes, and this particular branch of aeronautics is all the more interesting, because, while the very great amount of work done by the Royal Flying Corps and Royal Air Force on all the various fronts enables one to take a comprehensive view of the possibilities of the aeroplane for military purposes, where sheer and urgent necessity and its overwhelming advantages caused the higher authorities to be insistent on the latter and to demand constant extensions and additions to strength, the different circumstances attaching to naval work, and possibly a certain amount of conservatism, hampered the development of sea-aircraft, and it is only recently that we have begun to realize that air-power in connection with sea-power is bound to rise from the position of an auxiliary to that of a partner or ally with equal responsibilities and equal consideration, without whose co-operation our now dominant navy will be seriously handicapped in its operations and even its existence jeopardized.

When the war opened the seaplane was a reasonable proposition as regards overhead work, but few pilots had much experience of naval patrolling and their machines were anything but seaworthy from the point of view of surface-craft. The Royal Naval Air Service were nevertheless able to undertake a considerable amount of responsible work from the very commencement of operations against the Germans. Like the Royal Flying Corps the industrial starvation in regard to engines suitable for aircraft hampered their efforts, but they were better off in this respect than the R. F. C. because, owing to their dealings and arrangements with makers previous to the war, they had the first option in certain types of both aircraft and engines. Throughout the war they were, however, hindered to a considerable degree in the development of designs more especially suited for oversea work by the fact that their services had to be made available for operations which would properly fall within the province of purely military airmen, and their energies were to that extent dispersed instead of being concentrated on their main rôle of auxiliary to the navy; they were further entirely responsible for airships, a department of aeronautics which came to absorb much of their attention as time went on. Therefore any account of the naval services rendered by aircraft must include the work done in airships and in flying-boats, as well as in kite-ballons, which the R. N. A. S. introduced first for land service and then took out to sea for naval work.

The Royal Naval Air Service furnished the fleet with aircraft for reconnaissance purposes and for defence against the attacks of German rigid airships from November, 1914, and by the spring of 1915 they had been provided with a transatlantic liner and two smaller surface vessels as aircraft carriers, equipped with seaplanes, both for fighting and reconnaissance. These were in time replaced by aeroplanes which were flown from the decks and turrets of ships, while the latest were under cover. The general public had the opportunity of seeing something of these developments when a portion of the fleet lay off Southend this year in connection with Peace celebrations. The work of the aircraft as scouts was so obviously useful that not only were several other large "carriers" added to the fleet, such as the *Furious,* but by the time the armistice was declared measures were being taken for every battleship, battle-cruiser and light cruiser to carry its own aircraft on proceeding to sea. Already by July, 1918, no less than 70 aeroplanes were being carried by the fleet, as part of the battle equipment, and although few opportunities occurred for using them in face of the enemy owing to the latter's policy of refusing anything like an action, the arrangements for the employment of these aircraft previous to, during and subsequent to a fleet action, were carefully worked out, practised and sedulously improved upon from time to time. The assistance given by aerial scouting in the battle of Jutland, and the destructive action of aircraft during raids into Heligoland Bight, the bombing of Tönder and sundry aggressive and successful dealings with German airships over the North Sea were among the prominent features of the employment of aircraft in co-operation with surface vessels.

Incidentally it may be mentioned that although our preparations for utilizing heavier-than-air craft for naval purposes previous to the war may seem insignificant as seen through the perspective of over four years of such a tremendous conflict and because we have become accustomed to dealing with such large numbers of aircraft in war generally, the nucleus of our ultimate expansion and success was provided by the foresight and abounding energy of Mr. Winston Churchill, who was then in office at the Admiralty. It is quite possible, moreover, and certainly desirable that the navy, as it did in his time, should again assume control and entire responsibility for all matters connected with aeronautics so far as the development of the science and the administration of the personnel affect the sea-service. It is a sheer anomaly for the authorities responsible for one area to control a personnel which works always and entirely under the orders of another branch of the fighting-forces; naval aeronautics, expenditure on aircraft for sea-purposes (including coastal service), and the administration, recruiting, pay and general control of discipline and promotion should never have been divorced from that of the navy, and naval airmen should look to the Admiralty for everything. The mere fact of the final training of airmen for naval work differing from that given to those who are to work with the land forces, is proof enough of this, if any were needed. How can the work of a man in connection with the navy be adequately appreciated by any other than a naval authority, and to whom should an airman look for orders, approval and promotion, if not to the authorities under whom he works? It is extremely unlikely that the average airman would be equally good at overland and oversea work, the two forms of activity being so unlike in nature and appealing to different temperaments. A man cannot fairly be expected to be both soldier and sailor in these days of highly specialized methods and weapons, and since it seems impracticable to train men equally well for both sea and land work and switch them on to one or the other indifferently, it is surely wiser and more economical to keep sea-aeronautics separate from the land service. Whether it would still be necessary to maintain a separate department for the supply of matériel to both sea and land air services

is a moot question. The main reason for the ultimate junction, or mixture of the R. F. C. and the R. N. A. S. in 1918—one can hardly call it fusion, any more than one can call the mixture of such differently constituted liquids as oil and water a solution—was the difficulty of supply. One could not fail to condemn the confusion and costliness of a system under which two different service organizations, each requiring more or less similar types of weapons, machines and engines, each with its own predilections in favor of those suitable for its purposes, and each naturally "fighting for its own hand," to obtain the best and earliest supplies to meet its needs, went more or less as competitors into the market to purchase them. The case could hardly be otherwise when it is remembered that for the first half of the period during which hostilities were in progress the two air services for overland and oversea work were expanding and developing at high pressure on lines which, while not entirely parallel, were similar in their effect on the aircraft industry and the market for supplies. This became so obvious that in February, 1917, a serious effort was made to neutralize the defects of the system by the formation of the Air Board, upon which the army and navy were both represented, while at the same time all questions of supply were placed under an Aircraft Production Department of the Ministry of Munitions. The Air Board became responsible for the design and allocation of aircraft and accessories, but the actual administration of the two services remained separate. This arrangement held good until January, 1918, when the Air Board was reconstituted as the Air Ministry to take over the administration of both the R. N. A. S. and the Royal Flying Corps, which were ultimately amalgamated into the Royal Air Force in April of the same year. The latter thus became an independent fighting force, which for military purposes and under war conditions at the time on land was entirely justified. From the naval point of view it may well have been quite the reverse. In the future the whole of the fighting forces of the Crown may come to be under one authority to whom each will be directly responsible, and we may again see naval airmen under the immediate orders and administration of the Admiralty. By that time the importance of air power will have been firmly established, there will be a Joint Imperial General Staff to advise the Imperial Council in all problems of Imperial defence in relation to sea and air as well as land, and the functions of that portion of the Royal Air Force which serves in co-operation with the navy will require the undivided attention of men who are well versed in naval as well as aerial matters.

The duties of naval patrols were taken up by the R. N. A. S. in September, 1914, in so far as concerned submarines, and station after station for submarine-hunting purposes was established. Their duties consisted in patrolling for underwater craft, escorting convoys, and in assisting surface craft to deal with submarines known to be in their vicinity. By November last year there were 39 seaplane and 26 aeroplane coastal stations in existence (including those round the British coast and the Mediterranean) engaged on submarine duty. In the latter area the enemy U-boats were most active and demanded the closest attention on the part of our patrols, as well as in the Adriatic. Anti-submarine aircraft were also stationed in the Ægean, at Malta, Gibraltar and Alexandria. In the early part of 1917 a special wing was formed in Italy to assist the Otranto barrage in closing the southern end of the Adriatic to enemy submarines and in bombing the Austrian naval ports in the latter sea. The R. N. A. S. also undertook the bombing of lines of communication and places of military importance in Turkey and Albania. They supplied the whole of the air force employed in the Gallipoli campaign and did yeoman service in spite of severe hardships and difficulties without end in connection with transport, supply and workshop and repair arrangements. They also photographed the major portion of the peninsula for map-making purposes. Constant bombing operations were carried out against various objectives,

and frequent raids were made upon the enemy lines of communication, on the mainland and against the Turkish capital.

The Dardanelles campaign being a combined naval and military undertaking, it is a singular proof of the efficiency and all-round adaptability of the R. N. A. S. that they were able to supply all the information that could be obtained to meet the needs of both navy and army. A single Intelligence system was maintained, and the photographs taken and the results of observations were communicated to both naval and military staffs. The reconnaissance and patrol work carried out by the R. N. A. S. were of the utmost utility in assisting in the very difficult and entirely successful operations for the evacuations from Suvla and Melles.

The aircraft under naval orders in the locality of Harwich and the Nore, besides undertaking anti-submarine operations, were continuously engaged in locating and destroying mines laid by the enemy off the east coast of Great Britain. Moreover, special long-distance reconnaissance work was carried out from this area into localities where enemy seaplanes were particularly active and thus often resulted in heavy engagements with the opposing aircraft.

The operations of the R. N. A. S. in the Dunkirk district commenced very early in the war and continued to its close. They included persistent and heavy attacks on the enemy's submarine bases, which in the end completely crippled his aggressive power against our surface vessels, and were carried out in the face of the most formidable anti-aircraft defences, both mobile and fixed.

The R. N. A. S. also rendered conspicuous good service under trying conditions in the Red Sea, Palestine and East and Central Africa.

The work done by observation from kite-balloons was certainly one of the features of the Great War which deserve especial mention. We had made little use of them previous to 1914, a fact which is all the more remarkable because they were utilized by several continental nations, notably by the German Army, and had been found useful in the operations of the Italian and Spanish troops in Africa.

Four units of this branch were sent to France to operate with the army, and one unit was sent out to the Dardanelles in H. M. S. *Manica*, a merchant vessel chartered and fitted out for the purpose.

The work of these units was so successful that additional sections were rapidly formed. The R. F. C. took over the balloon work on the Western front, and five other vessels were equipped for balloon service in East Africa, in the Mediterranean, and off the Belgian coast.

At the end of 1915, a great advance in the development of balloons was made by the introduction of the practice of towing them from ships under way. The invention of the French Cacquot balloon in 1916 assisted in this development, and the employment of balloons towed from all types of ships, from submarines to battle-cruisers, for reconnaissance and artillery spotting purposes was soon a prevalent practice.

By July, 1918, no fewer than 30 balloons were being taken to sea by the Grand Fleet on all occasions.

Balloons aided materially in the anti-submarine campaign, and were towed from drifters, trawlers, and motor-launches in large numbers for reconnaissance purposes when hunting submarines and also when escorting convoys.

The expansion on the Western front was also great, and at one time there were 83 kite-balloon sections of the Royal Air Force.

A curious extension of their utility was to employ them as supports for anti-aircraft "aprons" of wire which were used in the defences of London, the moral effect being even greater than the physical, according to some accounts, more especially when taken in conjunction with the effective barrage put up during the latter end of the war, the opposition of our mobile aircraft defence, and the harassment of the enemy's aeroplanes on their return journey by the Dover-Dunkirk group of British aircraft.

Enemy raids on Great Britain did not assume serious proportions until 1915, before which hostile aeroplanes and airships came over merely for purpose of reconnaissance. During 1914 and 1915 the anti-aircraft organization was under the control of the Admiralty. In 1915 a few machines of the 18th Wing were specially detailed for defence against air raids, and in February, 1916, when the responsibility for home defence was taken over by the War Office, No. 19 Training Squadron, in addition to its training duties, was entrusted with the defence of London against enemy aircraft attacks; in addition, detachments each consisting of two B. E. 2 c. machines were stationed at various points around the capital.

The systematictraining of night flying pilots was not commenced at Hounslow until the armament and fittings for night flying were standardized.

The first home defence squadron (No. 39) was formed in May, 1916, and by the end of the year 11 home defence squadrons and one night training squadron had been formed and distributed throughout England.

During 1916 the squadron responsible for the defence of London accounted for five Zeppelins, and the squadron protecting the Tyne and Tees brought down one.

A home defence wing was formed in September, 1916, and in April, 1917, on the formation of the northern home defence wing at York, the existing home defence wing became the home defence group. This was later expanded and finally became the 6th Brigade. The organization of this brigade then consisted of six wings and 18 service squadrons in addition to 10 night training squadrons, four of which were night bombing squadrons. Its duties were: The aerial defence of England and South Scotland, co-operation with coastal batteries, the training of night flying pilots, and the formation of night fighting squadrons for the expeditionary forces. These night fighting squadrons had the valuable dual effect of reducing the enemy bombing of our back areas in France, and at the same time forming a first line of air defence against aerial attack on the British Isles.

The searchlight and anti-aircraft gun defences of London were at first under the control of the Admiralty, but in August, 1917, it was decided to place these and the aeroplane defences under a single command.

The London Aircraft Defence Area was accordingly formed under a general officer and the results emphasize the importance of co-operation between all units of anti-aircraft defence.

It is safe to say that not even the firmest believer in lighter-than-air craft could have foreseen the progress made in airship building in Great Britain during little more than four years from August, 1914. Our previous efforts in this direction were most disappointing to the advocates of this type of aircraft, none the less so because they had realized its great possibilities in connection with the navy long before.

On the outbreak of war this service consisted of 3 airships only, with a personnel of 24 officers and 174 other ranks; there were in November, 1918, 103 ships in service, with a personnel of 580 officers and 6534 other ranks.

During the transportation of the original Expeditionary Force to France in 1914, two of the three existing airships assisted in patrolling the Channel. These were subsequently employed on similar patrol duties from Kingsnorth and Barrow. The third airship was based at Dunkirk in the early part of 1915 and co-operated with the Belgian artillery at Ostend. The development of our present airship service, however, may be said to date from February, 1915, when approval was given for the construction of the first S. S. airship. During the year, 27 ships of this type were completed, the construction of a further 20 was begun, and the new "Coastal" type was also developed. In the meantime, experiments were directed to extending the range and duration of patrols and a number of other new types were produced and commissioned.

In August, 1915, an airship contingent was dispatched to the Dardanelles, and was incorporated in the force already referred to. Its headquarters were at first at Imbros, but were subsequently transferred to Mudros. Early in 1916 an outlying station was formed at Kassandra for anti-submarine work. Towards the end of 1916 one airship was stationed at Dunkirk and another was lent to the R. F. C. for work in France. In 1917 a detachment was sent to Italy in connection with six airships purchased by the Italian Government.

The duties carried out by the airship service were reconnaissance, coastal, and anti-submarine patrols, escorts, and mine detecting.

It is interesting to recall at the present time the inflated ideas with regard to the offensive possibilities of the airship which were held by such of the general public as had been misled by wild statements in the Press and the fantastic conceptions of novelists with regard to lighter-than-air craft in pre-war days, and then in due sequence to review in perspective the swing of the pendulum in the opposite direction, which was accentuated by every case in which a Zeppelin was brought down in flames by our anti-aircraft methods.

From the point of view of an instrument for aggressive purposes the airship really has neither gained nor lost ground. In the early days of the war it was remarkable how little use was made by the Germans, then the only possessors of a number of large rigid airships suitable for long-distance raids, of their presumed power to attack the British metropolis and other places of importance, because such raids would appear to fit in completely with the Prussian idea of making war on the civil population as well as against the armed forces and fortified places of an enemy. One can hardly imagine that it was want of courage or initiative, because these qualities cannot be denied to the enemy and were shown conspicuously in similar undertakings later in the war, and notably in 1915, 1916 and 1917. Latterly, it is true that the number of occasions on which Zeppelin raids on Great Britain took place diminished to vanishing point, but this was principally due to our improved anti-aircraft defences at home and the extreme likelihood of airships being caught at a disadvantage on their return across the Channel by the Dunkirk-Dover air-patrols made such expeditions so dangerous that it would have been playing into our hands to continue to use airships for such purposes when they were so extremely valuable for work in co-operation with the German Navy, and especially their submarines.

There is, however, nothing in this to prove that airships would not be very dangerous raiders of undefended localities, especially by night. Anti-aircraft defences can only be effective over a limited area, and it is the combination of searchlights, anti-aircraft artillery, "aprons," and fighting aeroplanes which makes the attack of areas dangerous alike to airships and heavier-than-air machines.—*United Service Magazine*, Dec. 1, 1919.

MISCELLANEOUS

SUEZ CANAL'S SEMI-CENTENNIAL.—This article, sketching the inception and progress of the Suez Canal during the last half century, was scheduled to appear at the time of the fiftieth anniversary in November last of the opening of that famous waterway. Owing to the delays occasioned by the printers' strike, however, we have been compelled to defer its publication until now. It was on November 17, 1869, that the Canal was formally opened by the French Imperial yacht, *L'Aigle*, with the Empress Eugenie on board, who is the only survivor of the many royal personages present on that notable occasion. During the first few years following its opening to traffic, the canal proved a losing venture, as the number of steamcraft in those days was comparatively limited. With the introduction of the compound engine and other improvements in steam navigation, which made the operation of sailing vessels on the main trade routes unprofitable, the canal

began to make money rapidly. To-day its shares are quoted at more than thirteen times their par value.

To French enterprise the construction of the canal is solely due. The British Government frowned upon the undertaking from the very start and placed every obstacle in its way. English statesmen declared it an impractical project and a French move to injure Britain's maritime supremacy. When M. de Lesseps proceeded to Constantinople in 1854 to obtain the sultan's confirmation of the khedive's grant for a concession, British diplomats succeeded in preventing him from obtaining the necessary consent for some years. Of the company's 400,000 shares of 500 francs each, 222,358 shares were subscribed for by private investors, who were for the most part French. The remaining 177,642 shares were taken up by the khedive. In 1875, they were purchased by Lord Beaconsfield for slightly less than $20,000,000, thus insuring to England a controlling voice in the management of the canal.

Traverse of the canal has always been a slow process. In its early days, vessels, except when they reached the Bitter Lakes, could only pass each other in a few especially provided places, which entailed the loss of much valuable time. Ten kilometers, or less than four knots an hour, is still the maximum speed permitted. In the eighties, the minimum width of the canal was enlarged to 213 feet, and the depth sufficiently increased to enable vessels of 15,000 tons to pass each other in safety in any part of the canal. From 1887 on, vessels equipped with searchlights have been permitted to navigate the canal by night. Britain's maritime predominance is indicated by the fact that more than half the tonnage passing through the canal prior to the war flew the British flag. As yet, the canal's traffic has not reached its pre-war level.—*The Nautical Gazette,* Jan. 10, 1920.

THE 24-HOUR CLOCK IN GREAT BRITAIN.—It is flattering to find one thing in which the practice of the services is said to be about to be copied by the nation at large. There must be many things in which the navy and army are ahead of the country, but it is another matter when the country admits the fact and desires to adopt service practice. The 24-hour clock, which renders unnecessary the use of "a.m." and "p.m." and is altogether much more simple and satisfactory as soon as its working has become familiar, has been under consideration by a Home Office Committee, and it seems likely that its recommendation will be decided upon. Certainly the experience gained by the services during hostilities appears to be in favor of the new clock. The navy was the first to adopt it and soon the army and the Royal Air Force took it up with good results. The railway companies since then seem to have been unanimously converted to the idea, encouraged probably by the fact that continental systems have for many years been using the 24-hour clock. From the naval standpoint the new time would undoubtedly be an advantage. The tide-tables published by the Admiralty use the 24-hour notation. It will help the smooth introduction of the system that large numbers of ex-service men now in civil life became familiar with it when they were in the forces. We hope the committee will soon make up their minds on this question.—*The Army and Navy Gazette,* Jan. 17, 1920.

GERMAN LOSSES IN THE WAR.—Official statistics of the losses incurred by Germany in the war are now published by the Department of Statistics of the Imperial Office of Health, states the Berlin correspondent of the *Morning Post.* These statistics refer only to the years 1914, 1915, and 1916, and are not even yet considered complete, for reports of deaths in those years are still reaching the central authorities. They are for the whole empire, excluding the two Mecklenburgs and Alsace-Lorraine, and show that the military persons who are officially reported as having died

in the year 1914 was 193,201; in 1915, 390,669; in 1916, 311,160; making a total for the three years of 895,030.

A Socialist publicist named Thiele, who collected lists of dead published during and after the war, states that these official lists contain the names of 1,718,246 persons belonging to the German Army who were reported dead, 1,655,553 of these being men in the ranks and 62,693 officers. The number of wounded according to these lists was 4,234,107, of whom 116,015 were officers, while the number of non-commissioned officers and privates reported as prisoners or missing is 1,050,516, and of officers 23,104, which brings the total loss incurred up to over seven millions.

According to the same lists the German Navy lost 24,112 sailors and petty officers dead, 29,830 wounded, and 11,654 prisoners. The number of naval officers who were killed and wounded during the war was not given.

The Imperial Office of Health reports that of the members of the German Army who died during the first three years of the war, 829,361, or 92.7 per cent, fell before the enemy or died of wounds received, and only 65,669, or 7.3 per cent, died of illness. Of these latter 7751 died of typhus, 6007 of infection resulting from wounds, 5248 of tuberculosis of the lungs, 5891 of inflammation of the lungs, six of smallpox, 2516 of dysentery, 66 of venereal diseases, 47 of leprosy, 1505 of diseases of the respiratory organs, 472 of concussion of the brain, 2006 of diseases of the nervous system, 4035 of diseases of the digestive organs, 1631 of diseases of the urinary and genital organs, and 2592 committed suicide. In 14,685 cases the cause of death could not be ascertained.—*The Army and Navy Gazette,* Jan. 17, 1920.

NAVAL CONSTRUCTION IN ITALY IN 1919.—The most interesting item of news from Italy is that the government has decided to resume work on the battleship *Caracciolo,* which was laid down at Castellamare in October, 1914, and abandoned in the following year. The *Colombo* and *Colonna,* two other battleships of the same type, are also to be completed; but the fourth vessel, *Morosini,* is to be dismantled. The design has been revised, and the three ships may now be appropriately described as "improved *Queen Elizabeths.*" Details are: Length, 661 feet by 97 feet by 30 feet; displacement, 30,900 tons; machinery, 105,000 shaft horsepower and 27 knots, boilers to burn coal and oil.—*The Engineer,* Jan. 2, 1920.

THE PERSONNEL OF THE GERMAN NAVY.—The personnel of the German Navy comprises 12 admirals, 34 full captains, 37 "frigate captains" or "corvette captains," 139 commanders (kapitaenleutnants), 312 first lieutenants (oberleutnants) and lieutenants, 77 naval engineers, 580 warrant officers (deckoffiziere), 3124 petty officers (unteroffiziere), 2274 senior seamen (obermatrosen), 6823 sailors (matrosen), total 13,469 men. In addition to the above, there are 1530 men employed in yards, docks and workshops.—*Hansa,* Nov. 8, 1919.

REINSTATEMENT OF WAR RISK INSURANCE.—The Bureau of War Risk Insurance has issued a statement saying that in order to relieve any confusion that may exist in the minds of former service men on account of the special provision of lapsed war term insurance which authorized reinstatement up to Dec. 31, 1919, regardless of date of discharge, the explanation is made that the provisions for reinstatement of lapsed or canceled insurance, within eighteen months from date of discharge, upon payment of two months' premiums on the amount of insurance to be reinstated, provided the insured is in as good health as at the date of discharge or expiration of the grace period, whichever is the later date, and so states in his application, still hold good. The provision that dis-

charged service men are permitted to reinstate at any time within three calendar months following the month of discharge by paying the two months' premiums, without making a formal application or a statement as to health, is also still in force. The provisions for reinstatement do not protect a man until he actually reinstates. If he waits he may not be in as good health as he was at the time of discharge and consequently may not be able to secure reinstatement.—*Army and Navy Journal*, Jan. 31, 1920.

VON TIRPITZ'S FAILURE.—*The German people did not understand the sea. In the hour of its destiny, it did not use its fleet. To-day, all that I can do for the fleet is to write its epitaph.*

Thus Grand Admiral von Tirpitz winds up his "Memoirs," the two volumes of which are devoted almost entirely to explaining the difficulties which he experienced in the production of the naval machine with which it was his aim to provide Germany, and with the reasons why that machine failed to achieve its purpose. It is the story of a gigantic failure, and not one which any man can have taken pride in writing. But von Tirpitz was not only a naval officer and administrator, but a politician, and as such it behooved him no doubt to endeavor to explain away mistakes, and to meet, however lamely, the charges which his own countrymen had brought against him. Quite apart from this, the two volumes he has written are full of lessons for ourselves, and it is assuredly the duty of every sea officer to make himself acquainted with their contents. We may truly learn by the faults and defaults of others, and in this story of the life-work of von Tirpitz and its unsuccessful outcome, there is very much which should prove useful to the naval officer, the naval architect, and the naval administrator.

In his narrative of the growth and development of the German Navy, and grand admiral describes in detail the obstacles which prevented its becoming an efficient machine until he himself was able to take its management in hand. Not that even then, according to his view, was he able to make it all that he could wish, and if we are to believe him, this was largely due to the incompetence of his predecessors, and the unsuitable material he had to work with. He refers to the want of any settled strategical scheme for the employment of the fleet, to the deficiencies in training and discipline brought about by the unsuitable field of selection for its officers, and to the inherent weakness of the short service system under which the men were raised. But the principal cause of the shortcomings which he depicts he alleges to be the lack of a unified control, and the independence of the various navy departments and commands. He has not a good word to say for the institution of a naval staff, and, indeed, both in the upbuilding of the fleet and during the progress of the war, it is of the opposition he received from the chief of this body that he most bitterly complains. From its very inception, moreover, the growth of the navy was hampered by the dominating prestige of the army, and this continued during the war, when the fleet was still regarded as merely a subsidiary appendage to the military arm. It was not, he says, until August, 1918, when almost everything was lost, that the admiralty and the supreme naval staff re-united in practice to form a supreme naval command, after they had been played off against one another for decades. It may be noted as a matter for reflection that it was about the same time that we in this country were effecting a separation of the departments for operations from those concerned with construction and maintenance. To the reformers who suggest the re-establishment of the navy board, some of the remarks made by von Tirpitz on the subject may be commended.

The grand admiral notes how in its early days the system of using the fleet was based upon the idea of sallying tactics—a small squadron capable of executing raids upon the enemy, and a larger force for coast defence. This strategical idea naturally affected the shipbuilding program and led, he says, to the construction of a miscellaneous assortment of types and units. Throughout his whole career, he says, he had always to oppose two ideas especially beloved of the lay mind—the idea of a special coast of defence, and that of a cruiser fleet for foreign service. "The world war has proved," he declares, "that the best coastal defence is a battle fleet." The object he had himself in view, when he came into power was the production of a fleet which would give to Germany what he describes as "alliance value," and, as a complement to this, an alliance policy with the avoidance of all friction in foreign policy before the end was achieved. Naturally he claims that the vessels built during his régime were far superior in design and equipment to those of this country. The grand admiral is also a devout believer in the aphorism that "favoritism is the secret of efficiency." He explains how, when he became chief of the staff, he took over the whole of his "torpedo crowd," and so had a body of experts at his immediate disposal.

The first and most lengthy volume carries us down to the beginning of hostilities, and the motif of the second is that "if the emperor had taken other advice, if he had followed his own real instincts, Germany would not now be lying in ruins." What that other advice was, von Tirpitz has no compunction in explaining. The grand admiral claims that with the failure to use the best, indeed at first the only, weapon against England the tragedy of Germany's lost opportunities began. He repeats that the causes of the navy's tragic fate were to be found in the obstacles placed for political reasons in the way of its active employment throughout the war, and the lack of a single responsible command of the whole of Germany's naval strength. He quotes a letter to the chief of the naval staff dated Oct. 1, 1914, in which he urged that the high sea fleet should be sent out to battle, and instances the naval history of all nations to show how difficult it is to maintain discipline in big ships in relative idleness. His description of the battle of Jutland is a travesty of facts, and in his discussion of the submarine campaign he endeavors to prove that if he had had the conduct of it, it would have been a success.—*The Army and Navy Gazette*, Nov. 29, 1919.

ARMY STRENGTH UNDER SENATE BILL.—The Senate Army Reorganization bill would greatly change the relative strength of the various arms, according to a study prepared by the statistics branch, general staff. The ultimate effect would be to reduce the enlisted strength of the infantry, cavalry, coast artillery, signal corps and quartermaster corps, while increasing the air service, field artillery and medical corps. Compared with the provisions of the National Defence Act, the enlisted strength after five years under the Senate bill would stand in per cent of that under the National Defence Act thus:

Air service, 475 per cent; corps of engineers, 213 per cent; field artillery, 160 per cent; unassigned, 135 per cent; medical corps, 119 per cent; ordnance department, 100; signal corps, 96; infantry, 73; coast artillery corps, 70; quartermaster corps, 45; cavalry, 41. In other words, ordnance would stand as it does to-day in the National Defence Act, while the signal corps would be cut 4 per cent; the infantry 27 per cent, the coast artillery corps, 30 per cent, the quartermaster corps 55 per cent, and the cavalry 59 per cent. Tabulated, the strength allowance shows the appended comparisons:

	National Defence Act	Senate Bill: Initial	Senate Bill: After 5 Years
Air Service	3,320	21,000	15,750
Corps of Engineers	5,633	16,000	12,000
Field Artillery	18,249	39,000	29,250
Unassigned	13,889	25,000	18,750
Medical Department	10,615	16,800	12,600
Ordnance Department	4,500	6,000	4,500
Signal Corps	3,913	5,000	3,750
Infantry	96,383	94,000	70,500
Coast Artillery Corps	30,126	28,000	21,000
Quartermaster Corps	15,000	9,000	6,750
Cavalry	25,554	14,000	10,500
Transportation Service	0	12,500	9,375
Construction Service	0	6,000	4,500
Chemical Warfare Service	0	1,200	900
Finance Service	0	900	675
Adjutant General Service	0	400	300
Inspector General Service	0	100	75
Judge Advocate Gen'l Service	0	100	75
Adjustment*	0	(—) 15,000	(—) 11,250
Authorized total	†227,698	280,000	210,000

The services not provided for in the National Defence Act—Transportation, Construction, Chemical Warfare, Finance, The Adjutant General's, Inspector General's and Judge Advocate General's—get a total initial strength of 21,200 under the Senate bill, but with these additional services the enlisted strength of the regular army will be 8990 under the strength allowed in the National Defence Act five years hence, or nine years after the passage of the latter act the regular army will have shrunk 17,698 men.—*Army and Navy Journal*, Jan. 31, 1920.

THE AMERICAN METEOROLOGICAL SOCIETY.—Objects: The advancement and diffusion of the knowledge of meteorology and climatology; and the broadening of their applications in public health, agriculture, engineering, aeronautics, industry and commerce.

Since the publication of the orginal announcement in *Science*, August 22, 1919, several thousand circulars have been distributed among prospective members. Up to January 20, 1920, when the society was organized, 575 had indicated their desire to join. Roughly, the percentage make-up of these is as follows:

1. Weather Bureau	37
2. Cooperative observers of the Weather Bureau	6
3. Army, navy and other government people professionally interested in meteorology	8
4. Business men, farmers, engineers and others professionally interested in meteorology	8
5. Teachers and students	16
6. Canada	2
7. Latin America	3
8. Amateur meteorologists (not classed above) includes those formerly engaged in meteorological work	20
Total	100

*Amount by which sum of authorizations for services exceeds total authorization.

†Includes 516 for U. S. Military Academy detachment.

Of the whole number 40 per cent are professional meteorologists. Many have urged strongly that the practical applications of meteorology be emphasized and that special efforts be made to interest engineers, business men, shippers, farmers, fruit growers, aviators and others whose work is closely dependent on the weather. Those who study merely for its scientific interest will have much to gain from association with those who apply meteorology in the conduct of their business. Two leading views expressed concerning the type of organization are:

(1) That the society should be popular in nature in order to get as many as possible interested in the scientific aspects and applications of meteorology and climatology, and in this way to advance the science by united effort and funds to promote research, and (2) that the society should be strictly scientific, and have rigid qualifications for membership, so that the professional meteorologists can by close personal contact cooperate in research to the best advantage. These two views may not be incompatible if the society when organized welcomes as a member any one who is interested in the aims of the society, and elects from among the members, fellows, as a recognition of eminence in meteorology or climatology. It is generally agreed that all members and fellows should have the same privileges and pay the same dues. The council of the society would, naturally, be composed almost of fellows. Thus, the affairs of the society would be directed by its scientists, with the close backing of a large body of interested members.

(2) Dues must be sufficient to pay current expenses of issuing a periodical leaflet of news, notes, queries, etc., but they must not be burdensome for the large group of underpaid government employees and teachers who are interested. If more than 500 members are procured, dues of $1 per year would probably be sufficient. Much has been said in favor of an endowment fund, and, as some have suggested, also library, instrument, scholarship, and building funds. To procure endowment, the society will probably be incorporated and provisions made for contributing, sustaining and patron memberships.

A preliminary meeting to discuss organization plans and to nominate officers of the American Meteorological Society was held at the close of the meteorological program of the Philosophical Society of Washington, Saturday evening, December 20. The meeting for organization took place in St. Louis, December 29, and sessions for the presentation of papers were held December 30 and 31.—*U. S. Weather Bureau*, Washington, D. C.

CURRENT NAVAL AND PROFESSIONAL PAPERS

Discussion of Contracts—A Comparison of "Cost Plus" with other forms. *Proceedings of the American Society of Civil Engineers*, Vol. XLV (Oct.-Nov.-Dec.), 1919.

Electric Welding as Applied to Ship Building. By Comfort A. Adams. *Journal of the Western Society of Engineers*, March, 1919.

Jellicoe's Grand Fleet (Review). By Rear Admiral Bradley A. Fiske. *American Historical Review.*

A Captain in the Navy (Vicissitudes on Board a Transport). By Ralph R. Perry. *Atlantic Monthly*, February.

The Removal of the North Sea Mine Barrage. By Lieut. Commander Noel Davis, U. S. N. *National Geographic Magazine.*

Where the World gets its Oil. By George Otis Smith. *National Geographic Magazine.*

Submarine Sea Salvage Pumps. *Scientific American Monthly*, February.

The Death of a Big Gun (A Study in Erosion). By Arthur Benington. *Scientific American Monthly*, February.

The Ninth Cruiser Squadron. By Rear Admiral Boyle Somerville. *Blackwood's Magazine*, January.

The Settlement of the Near East. By Viscount Bryce. *Contemporary Review*, January.

The Dardanelles Campaign. By Charles Woods. *Contemporary Review*, January.

NOTES ON INTERNATIONAL AFFAIRS

FROM JANUARY 15 TO FEBRUARY 15

PREPARED BY

ALLAN WESTCOTT, Associate Professor, U. S. Naval Academy

TREATY DISCUSSION RENEWED IN SENATE

On February 9 the U. S. Senate by a vote of 63 to 9 decided again to bring up the Peace Treaty for discussion. This followed the failure of informal conferences among senators to agree on the phrasing of the reservation on Article X of the League of Nations covenant providing for economic and military protection of all members of the League against territorial or political aggression.

The difficulty over this reservation appeared to reduce itself to a question of assuming *"no obligation under the article,"* or *"no obligation to take action under the article"* without the consent of Congress. On Feb. 13, 28 Democratic senators agreed to support either of two forms for this reservation, one proposed in the senatorial conference, and the other by ex-President Taft.

GREY DECLARES RESERVATIONS ACCEPTABLE.—In a letter to the London *Times* published in the American press on Jan. 31, Viscount Grey, British Ambassador to the United States, explained the reasons for American opposition to unqualified acceptance of the League Covenant, and declared he saw nothing objectionable in most of the reservations proposed by the Senate. As to the reservation regarding the 6 votes in the League Assembly granted to Great Britain and her self-governing dominions, he expressed the opinion that the dominions would object to loss of a vote, but that "to any provision which would make it clear that none of the British votes can be used in a dispute likely to lead to a rupture in which any part of the British Empire is involved, no exception can be taken." Of the reservations in general he said:

The difficulties or dangers which the Americans foresee in it will probably never arise or be felt by them when they are once in the League. And in the same way the weakening and injury to the League which some of its best friends apprehend from the American reservations would not be felt in practice.

If the outcome of the long controversy in the Senate has been to offer co-operation in the League of Nations it would be the greatest mistake to refuse that co-operation because conditions are attached to it, and when that co-operation is accepted, let it not be accepted in a spirit of pessimism.

It may be assumed that in expressing these views Lord Grey was in harmony with the attitude of the British Government. In France, also,

unofficial expressions of opinion indicated willingness to accept the United States into the League of Nations, on the basis of the reservations.

SECOND LEAGUE OF NATIONS MEETING IN LONDON.—The second meeting of the League of Nations Council was held in London on Feb. 11-13 at the time of the assembly there of Allied diplomats. Representatives of Great Britain, France, Italy, Japan, Belgium, Brazil, Spain, and Greece were present, leaving the United States the only nation entitled to a delegate and not represented. It was announced that the next meeting would be held in Rome on March 15.

Four of the five members of the Sarre Basin Commission were appointed; they included a French representative, one for Sarre itself, one for Denmark, and one for Belgium.

A committee of distinguished legal authorities of various nations was appointed to devise plans for a "permanent court of international justice." Among the names of those selected was that of ex-Secretary of State Elihu Root. Denmark, Norway, Sweden, Switzerland and Holland also had representatives on the committee.

At the first meeting of the League Council it was announced that of the 13 neutrals invited, Spain, Argentina, Uruguay, Chili and Persia had joined the league. At the second meeting Switzerland was admitted, subject to the reservation on her part of participating only in economic and not in military pressure under Article X, and subject also to a Swiss referendum on the question of joining at all. Switzerland's admission without the pledge of military support was justified by Mr. Balfour, who presided at the League meeting, on the grounds of her traditional neutrality.

SCANDINAVIAN STATES WILL JOIN LEAGUE.—Copenhagen, Feb. 4.—The Scandinavian premiers and foreign ministers, at a conference held here, have decided to accept the invitation to join the League of Nations, it was learned to-day.

The decision was arrived at without enthusiasm, as it was considered that without the United States the League did not guarantee much, but owing to the conviction that small countries were unable to afford an independent attitude on foreign policy it was considered best to join the League.

GERMANY OPPOSES EXTRADITION OF WAR CULPRITS

On Feb. 7 the allied list of 780 German Army officers and officials accused of crimes during the war was presented to the German Government by the French Chargé d'Affaires at Berlin. The list was accompanied by a brief letter rejecting the proposal of the German Government on Jan. 28 that trial in German courts be substituted for trial before an international tribunal. The list and letter were first presented to Baron von Lersner, the German representative at Paris, who refused to transmit them and submitted his resignation to his government.

Following Baron von Lersner's refusal to transmit the Allied "black list," there was some disposition on the part of the Committee of Ambassadors representing the western powers to concede that acceptance of the

list by Germany, constituting a recognition in principle of offenses against the laws of war, would be followed by less stringent demands regarding extradition and trial.

During the Allied conference at London on Feb. 11-13 a new note to Germany was prepared. This consented to trial in German courts, the Allies preserving the right to present evidence and review the decisions.

Public sentiment in Germany was strongly for the utmost resistance to the demands for extradition. War Minister Noshe declared he would take no step to apprehend or deliver the persons accused. The charges against the accused were regarded as in many cases flimsy or unsupported.

HOLLAND AVERSE TO SURRENDER OF EX-KAISER

THE ALLIED NOTE TO HOLLAND.—On Jan. 15 the Supreme Council sent a note to the Dutch Government requesting that the former German emperor be delivered to the powers for trial in accordance with Article 227 of the Treaty of Versailles. The note pointed out that, had the former emperor remained in Germany, he would have been delivered over by the German Government under the same conditions.

"Among so many crimes," the note recalls, "the cynical violation of the neutrality of Belgium and Luxemburg, the barbarous system of hostage, massed deportations, systematic devastation without military reasons, the submarine war, for all of which acts responsibility, at least moral, reaches the supreme chief, who ordered them or abused his unlimited powers to break, or permit others to break, the most sacred rules of human conscience."

"The Powers cannot conceive," it adds, "that the Netherlands would regard with less reprobation than themselves the immense responsibility weighing upon the ex-emperor. Holland would not be fulfilling her international duty if she refused to associate herself with other nations, so far as she is able, to prosecute, or at least not impede, the punishment of crimes committed."

The note points out that it is the duty of the Powers to insure execution of Article 227 without entering into argument, because "it is not a question of public accusation having throughout a legal character, but an act of high international policy imposed by the universal conscience, in which legal forms are employed solely to insure the accused body guarantees such as have hitherto been unknown in public law."

DUTCH GOVERNMENT REFUSES SURRENDER.—On Jan. 23 the Allied Powers received a reply from Holland declining to surrender the ex-kaiser. This decision was based on the grounds that there was at the present time no established international jurisdiction competent to deal with his case, that Holland was in no way party to the Treaty of Versailles, and that the laws and traditions of Holland granted asylum to political refugees.

At the London conference on Feb. 11-13 the Allied diplomats prepared a new note to Holland with a view to re-opening negotiations, and intimating the need of interning the former emperor outside of Europe, for example in the Dutch East Indies.

JUGO-SLAVS OPPOSE ADRIATIC SETTLEMENT

Before the disbanding of the Supreme Council on Jan. 20, a reply was received from Jugo-slavia making various reservations regarding the

Adriatic settlement which had been presented to her. The reply demanded the island of Lissa and inclined to insist on the proposals made by President Wilson; it accepted the internationalization of Fiume and Zara.

Following a message from the Allies that if the terms were not accepted those of the Secret Pact of London would be carried out, the Jugo-slavs on Jan. 28 replied that they had no official knowledge of the terms of the London Agreement, but were still ready to accept a solution along the lines of President Wilson's 1919 proposals.

On Feb. 13 the Council at London prepared another note to Jugo-slavia insisting on a speedy agreement.

HUNGARY INCLINES TO MONARCHY

The Hungarian Peace Terms were handed to Count Apponyi, head of the delegation from Budapest, at Paris on Jan. 15, with a period of 15 days for consideration, which was later extended until March 4. The first meeting of the Hungarian National Assembly was set for Feb. 16.

In view of rumors that the Hapsburg dynasty would be restored in Hungary, the Council of Ambassadors at Paris on Feb. 2 issued a statement that such a restoration would not be recognized or tolerated by the principal Allied nations.

TRADE RELATIONS WITH RUSSIA

On Jan. 16 the Supreme Council issued the following statement announcing the policy of resuming trade relations with Russia:

With a view to remedying the unhappy situation of the population in the interior of Russia, which is now deprived of all manufactured products from outside of Russia, the Supreme Council, after taking note of the report of a committee appointed to consider the reopening of certain trade relations with the Russian people, has decided that it would permit the exchange of goods on the basis of reciprocity between the Russian people and allied and neutral countries.

For this purpose it decided to give facilities to the Russian co-operative organizations which are in direct touch throughout Russia so that they may arrange for the import into Russia of clothing, medicines, agricultural machinery and the other necessaries of which the Russian people are in sore need, in exchange for grain, flax, etc., of which there is a surplus supply.

These arrangements imply no change in the policies of the allied governments toward the Soviet Government.

Following this announcement, the Council on Jan. 26 made public a note to the Russian Central Co-operative Union in Moscow laying down definite proposals for export of Russian foodstuffs and raw materials in exchange for clothing and other merchandise to be sent to Russia.

The exchange, on the condition of continued hostility to the Soviet Government, was made difficult, however, by the assumption of complete control over the Co-operative Societies by the Soviets.

LLOYD GEORGE ON THE RUSSIAN PROBLEM.—At the opening of the British Parliament on Feb. 10, Premier Lloyd George discussed the Russian problem as follows:

Mr. Lloyd George said he agreed with the view that Europe could not be restored without putting Russia, with all her strength and resources, into circulation.

Bolshevism was possibly efficient, said the Premier, but it was not democracy, and Russia must be restored under an anti-Bolshevist régime.

"Bolshevism cannot be crushed by force of arms," continued the premier.

"I held that opinion a year ago, but my advice, tendered on that assumption to the warring factions, was declined. It was necessary to give the anti-Bolshevists a chance to recover Russia, but they failed. The failure was not due to lack of equipment but to more fundamental causes."

The premier contended that the suggested "ring of fire" to crush the Bolsheviki was impossible because it was doubtful whether Finland would consent, and the Baltic States were making peace with Russia, while Rumania was really engaged in watching the Hungarian front and the Japanese were disinclined toward the idea. Moreover, neither France, the United States, Italy, nor Great Britain was willing to provide the funds.

"Until," added the premier, "they are assured that the Bolsheviki have dropped the methods of barbarism in favor of civilized government, no civilized community in the world is prepared to make peace with them. Further, there is no established government possessing the right to speak for the whole of European Russia. We failed to restore Russia to sanity by force. I believe we can save her by trade.

"Commerce has a sobering influence. There is nothing to fear from a Bolshevist invasion of surrounding countries or the Middle East, because the Bolsheviki cannot organize a powerful army. I believe that trading will bring to an end the ferocity, rapine and cruelties of Bolshevism more surely than any other method, and Europe badly needs what Russia is able to supply but cannot supply with contending armies moving across the borders."

SOVIETS PROPOSE PEACE WITH POLAND.—Peace offers were made to Poland by the Soviet Government during the last week in January, on the basis of full recognition of Polish independence. Conferences with the western powers indicated that no opposition could be raised on their part to such a course on the part of Poland, since it would be impossible for Poland to continue hostilities without Allied aid and without the full support of the Baltic States.

SOVIET-ESTHONIA PEACE TERMS.—A permanent peace was signed between the Soviet Government and Esthonia on Feb. 2. The Soviet recognized Esthonia's independence, accorded her $7,500,000 in gold as her share of the treasure of the old empire, and freed her from her share of the imperial debt.

BALTIC CONFERENCE AT HELSINGFORS.—At a conference of the former Russian Baltic provinces and Poland, held at Helsingfors Jan. 14-21, it became clear that no aggressively hostile policy could be agreed upon against Soviet Russia, owing partly to the withdrawal of Allied support, partly to hostility between Lithuania and Poland, and partly to the fact that Esthonia was on the verge of peace with the Soviets. A commission

was appointed to work out a plan of defensive alliance. A second conference will be held in April.

UNITED STATES OPPOSED TO BREAK-UP OF RUSSIA.—On Feb. 9, Secretary Lansing made public a letter to Lithuania refusing recognition of her independence. A later letter, dated Jan. 7, and addressed to Lithuanian diplomatic agents in the United States, offered to take up informal dealings with Lithuanian representatives, but reiterated the policy of non-recognition. The reason for this was stated in the opening of the first letter.

STATE DEPARTMENT,
WASHINGTON, OCT. 15, 1919.

Gentlemen: The department has received your letters of Oct. 2 and 9, 1919, on the subject of the provisional recognition of Lithuania.

The question of the future status of Lithuania has been given careful consideration. As you are aware, the Government of the United States is traditionally sympathetic with the national aspirations of dependent peoples. On the other hand, it has been thought unwise and unfair to prejudice in advance of the establishment of orderly, constitutional government in Russia the principle of Russian unity as a whole.

KOLCHAK EXECUTED BY REDS.—It was learned definitely that on Feb. 7 Admiral Kolchak was shot, in accordance with the sentence of a court martial, by the Revolutionary Committee at Irkutsk.

Early in February Soviet forces occupied Odessa on the Black sea, encountering slight opposition and securing large quantities of supplies. British naval vessels and the U. S. destroyer *Biddle* took off refugees. According to a despatch of Feb. 13 the Soviet commander threatened to open fire on the British vessels unless they left the port.

DESCHANEL ELECTED PRESIDENT OF FRANCE

On Jan. 17 the French Senate elected Paul Deschanel, who was then presiding officer of the Senate, President of France. In the preliminary caucus on the day before, Premier Clemenceau received 389 votes to Deschanel's 408, and at once withdrew from the contest. His defeat was due in part to the opposition of radical elements and the activities of ex-Premier Briand.

Following the election, the Clemenceau cabinet resigned and was succeeded by a new ministry under Alexandre Millerand, including the following members:

Premier and Foreign Minister—ALEXANDRE MILLERAND.
Minister of Justice—M. L'HOPITEAU.
Interior—JULES STEEG.
War—ANDRE LEFEVRE.
Marine—M. LANDRY.
Commerce—M. ISAAC.
Agriculture—HENRI RICARD.
Finance—FREDERIC FRANCOIS-MARSAL.

FRANCO-ITALIAN ENTENTE OF 1902.—M. Barrère, who for twenty-three years has been the French Ambassador at the Quirinal, made an important diplomatic disclosure at a reception he gave the French colony on Dec. 31. He said that in 1900 and 1902 he had negotiated defensive treaties with

Italy as an offset to the Triple Alliance, in which Italy realized she could not be an active partner to in case Germany went to war with both France and Great Britain.

He said that the treaty of 1900 eliminated every cause of conflict in the Mediterranean, and traced the Italo-French spheres of influence in Africa. The treaty of 1902 added the stipulation that in case of aggressive war against either nation, the other would remain neutral.—*N. Y. Times*, Current History, January.

FAR EAST

JAPAN INVITES CHINA TO DISCUSS SHANTUNG.—On Jan. 15 the Japanese Government, having succeeded to German rights in Shantung by ratification of the Peace of Versailles, extended an invitation to China to begin discussions regarding the new régime in the province. According to a Japanese statement of Jan. 25, Japan desired to withdraw her troops along the Shantung railway as soon as possible.

REVOLT IN KOREA.—A fresh outbreak of revolt in northern Korea, fostered by Russian Bolsheviki on the Manchurian and Siberian frontiers, was reported on Feb. 9. A clash between 2000 Koreans armed by the Bolsheviki, and 700 Japanese resulted in the defeat of the latter. There are three divisions of Japanese troops in Korea.

JAPAN'S STRONG DEFENSIVE POSITION.—Washington, Jan. 20.—Close study of the military situation throughout the world in the light of recent important changes in the military and political situation is being made by military experts and diplomats in Washington, who are especially concerned over the spread of Bolshevist militarism, and speculating as to the rôle Japan will play in the changed situation.

The study has convinced military experts that Japan is in a greater position for military offensive and defensive operations at the present moment than ever before. The outstanding fact is that Japan is the only great power with a large national army that can be quickly mobilized and thrown into war anywhere at will. Before the outbreak of the world war in 1914, there were other nations that could use their armies at will, notably Germany and Austria, but they cannot longer do so. Japan is the single remaining great power that is not hedged around by the check against using the military forces without express approval of legislative bodies.

Military experts have also discovered that a second important element of power is possessed by Japan through the acquisition of the Pacific Islands north of the Equator. These have furnished Japan with an insular barrier of defence against naval attack which is regarded as giving her control over the whole Pacific Ocean front of Asia.

This barrier starts with the Kurile Islands near Kamchatka. These link up with the Empire of Japan proper which extends to the Island of Formosa, off the coast of Duchau. The chain extends via Bonin, the Ladrones, Mariane and Caroline Islands east of the Philippines to Micronesia. With possession of the Pacific Islands north of the Equator, Japan now has a complete natural insular barrier which she is understood to be planning to utilize in setting up an elaborate system of submarine torpedo boat defence.

Japan is known to be making an intensive study of the possible use of submarines based on this long chain of islands, and is training submarine officers, and making a special study of the operations of German submarines in the world war. These newly acquired islands, in conjunction

with those which were previously owned by Japan, are regarded as giving that nation immunity from naval coercion by sea, and the opportunity to throw a submarine barrier between the United States and the Philippines.

The third element in the power that Japan has acquired through changed conditions is geographical. Formerly Japan was faced from the continent of Asia by the Russian Empire. This is no longer the case and Japan is not threatened with attack from the continent by any power other than the menace contained in the eastward advance of the Bolshevist forces through Siberia.

This is a menace which the rest of the world also now concerns itself about seriously, and has been under consideration by the allied powers. The Bolshevist military control now extends from the Polish frontier to Irkutsk, and has been spreading toward the Black Sea and the Dardanelles, across the Caspian Sea through Turkestan and Afghanistan toward India and Mongolia. Military experts are now convinced that the Bolsheviki have a more stable military power than at any time since the Soviet revolution was initiated.—*N. Y. Times,* Jan. 21.

MISCELLANEOUS

NORTH SCHLESWIG VOTES FOR DENMARK.—Copenhagen, Feb. 11.—Latest reports as to the result of the plébiscite held yesterday in Schleswig show that Denmark secured 72,733 votes against 24,793. Only a few districts have not been heard from.

In spite of the bad weather which prevailed, more than 90 per cent of the people in the first Schleswig plébiscite zone voted during the day, and about 75 per cent voted in favor of Danish sovereignty. In the country districts there were virtually no German votes, only descendants of German settlers casting their ballots in favor of Germany.

REVIEW OF BOOKS
ON
SUBJECTS OF PROFESSIONAL INTEREST

"Radio Engineering Principles." By Henri Lauer, B. S., Formerly Lieutenant, Signal Corps, U. S. A. Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, B. E. E., Formerly Captain, Signal Corps, U. S. A., In Charge of the Preparation of the Technical Training Literature Used in the Signal Service. (McGraw-Hill Book Company, Inc.)

The aim of the authors, as stated in the preface, was to produce "a general text-book on radio covering the new and extensive developments in the art made during the war." In developing the book along these lines the authors have given a theoretical treatment of the subject, with only a moderate amount of mathematics, and absolutely no mechanical analogues. Approximately one-half of the subject-matter of the book is devoted to the study of the characteristics and use of the three-electrode vacuum tube in radio telegraphy and radio telephony. Of the remainder, the first chapter deals with the underlying electrical theory, and the balance is devoted principally to the older types of apparatus.

On the whole, there is a collection of much valuable information in the book, but there are also many small and some serious mistakes. For example, in Figs. 172, 207, 208 and 212 we find that vacuum tube circuits intended for the generation of undamped oscillations will not generate, for, in each case, the full high voltage from the plate battery is supplied to the grid as well as to the plate. (The person familiar with vacuum tube circuits knows that this is an absolute bar to normal operation of the tube.) While these mistakes may be of minor importance to the person familiar with the subject and interested in the volume only as a reference, they would undoubtedly prove very confusing to a student and cause the book to fall short of its aim as a text-book.

G. D. Robinson.

"Elementi di Navigazione Astronomica (Elements of Astronomical Navigation)." By Luigi Tonta, Capitano di Fregata. 507 pages. (Published by Raffaello Giusti, Livorno, Italy.)

This book was written by Commander Tonta of the Italian Navy for use as a text-book at the Royal Naval Academy.

The book, as its title indicates, is a treatise on the astronomical elements of navigation. The rudiments of navigation, such as the sailings, piloting, etc., are not touched. The book, as a text-book, is undoubtedly intended for students who have completed the fundamentals of navigation.

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The astronomical part of navigation and the mathematics are thoroughly explained and illustrated. The explanations are excellent and complete. However, this book does not go into the practical day's work of a navigator at sea as deeply as do our Naval Academy text-books.

The explanation of the uses of lines of position is very good and complete. The intersection of lines of position, running up lines of position and the special handling of such lines are done upon the Mercator chart and the computation of this work is not given.

Compass compensation is not taken up in this book.

No unusual methods are mentioned.

T. WITHERS, JR.